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ABSTRACT

This packet contains both teacher and student materials for a unit on poultry production in vocational agriculture courses and covers the following lessons: (1) overview of the poultry industry; (2) selection and evaluation; (3) production; (4) reproduction; (5) health issues; and (6) processing and marketing. The lessons include the following components: competencies, objectives, study questions, teaching procedures, activities, activity sheets, evaluations and answers to evaluations. In addition, the instructor guide includes unit objectives, 21 references, a competency profile, and a competency crosswalk. The student reference contains information sheets for each of the lessons. (KC)

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Introduction to Poultry Production

In cooperation with
Agricultural Education
Department
College of Agriculture,
Food and Natural Resources
University of Missouri-Columbia

In cooperation with
Agricultural Education Section
Division of Vocational
and Adult Education
Department of Elementary and
Secondary Education
Jefferson City, Missouri

CE 077 453

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Instructional Materials Laboratory
University of Missouri-Columbia

INTRODUCTION TO POULTRY PRODUCTION

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FOREWORD

The development of the *Introduction to Poultry Production* curriculum guide is the result of suggestions by the MVATA Teaching Aids Committee. The Poultry Production Advisory Committee suggested the topics to be included and reviewed the materials.

This curriculum contains six lessons that can be taught in 15, 50-minute class periods. Topics include overview of the poultry industry, selection and evaluation, production, reproduction, health issues, and processing and marketing.

During the summer of 1981, the Missouri State Board of Education formally adopted the concept of "Instructional Management Systems" (IMS) as a priority for the 1981-82 school year. The Missouri Commissioner of Education described the IMS concept as a practical way of "organizing for excellence" in education. To meet the demand for greater productivity and accountability, the director of Vocational Education applied the elements of IMS to form the Vocational Instructional Management System (VIMS). The VIMS process provides a framework to use in planning and organizing to assure excellence in Missouri's vocational education system by focusing greater attention on the management of teaching and learning.

This guide incorporates the needed components to aid agriculture teachers in the implementation of VIMS. For ease of use, performance objectives and competencies have been included at the beginning of the guide as well as incorporated within each lesson. A competency profile has been provided in the front of the guide for convenient record keeping. A table is included to show how the competencies in *Introduction to Poultry Production* relate to the Show-Me Standards and Curriculum Frameworks. *Introduction to Poultry Production* is in the Natural Resources career path.

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Secondary Education

INTRODUCTION TO POULTRY PRODUCTION

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COMPETENCIES/OBJECTIVES

1. Describe the importance of the poultry industry in Missouri.
2. Select and evaluate poultry.
3. Describe poultry production and management practices.
4. Explain poultry reproductive processes.
5. Identify poultry flock health issues.
6. Identify procedures involved in processing poultry products.

EVALUATION

1. Give short, objective tests following each lesson and a more in-depth objective test at the conclusion of the unit.

2. Observe the changes in behavior as evidence of the improved ability of students to deal with problems in this unit using background information acquired from earlier units.

3. Observe students' attempts to solve similar problems in their supervised agricultural experience programs.

REFERENCES AND MATERIALS

1. Student References

   a. *Introduction to Poultry Production (Student Reference).* University of Missouri-Columbia: Instructional Materials Laboratory, 1999.

   b. *Introduction to Animal Reproduction (Student Reference).* University of Missouri-Columbia: Instructional Materials Laboratory, 1996.

4. Teacher References

   a. Books

      1) *1998 Missouri Farm Facts.* Columbia: Missouri Agricultural Statistics Service in cooperation with the Missouri Department of Agriculture and the U.S. Department of Agriculture, 1998.

      2) Ensminger, M.E., *Poultry Science.* 3rd ed. Danville, IL: Interstate Publishers, Inc., 1992.

      3) Field, Thomas G., and Robert E. Taylor. *Scientific Farm Animal Production. 6th ed.* Upper Saddle River, N.J.: Prentice-Hall, Inc. 1998.

      4) Gillespie, James R., *Animal Science.* Albany: Delmar Publishers, 1998.

      5) Gillespie, James R., *Modern Livestock and Poultry Production. 5th ed.* Albany: Delmar, 1997.

      6) Hall, Michelle A., ed. *Introduction to Avian Bowl,* Clemson University, Clemson, SC, 1997.

      7) Kelly, Debi. Personal Communication. MO Alternative Center, University Extension. University of Missouri, Columbia. 20 March 1998.

      8) North, Mack O., *Commercial Chicken Production Manual.* 3rd ed. Westport, CT: AVI Publishing Co. Inc. 1984.

      9) Moreng, Robert E. and John S. Avens. *Poultry Science and Production.* Prospect Heights, Ill.: Waveland Press, 1991.

      10) *National 4-H Avian Bowl Manual.* Cooperative Extension Service, Clemson University. Clemson, NC. 1992.

      11) *National Poultry Judging Manual.* National 4-H Poultry and Egg Conference Extension Committee. Nebraska Cooperative Extension. 1998.

      12) *Statistical Highlights of U.S. Agriculture, 1997/98.* Missouri Agricultural Statistics Service in cooperation with the Missouri Department of Agriculture and the U.S. Department of Agriculture, 1998.

b. University of Missouri Cooperative Extension publications

1) *Small Flock Series: Incubation of Poultry (G8353).* (1998). 1 June 1999. University Extension Agricultural Publications, University of Missouri - Columbia. <http://muextension.missouri.edu/xplor/agguides/poultry/g08353.htm>.

c. Internet resources

1) *Bacterial Diseases.* (1997). 18 May 1999. Cooperative Extension Service. Mississippi State University. <http://www.msstate.edu/dept/poultry/disbact.htm>.

2) *Biosecurity of Poultry Facilities.* (1998). 18 May 1999. Texas Agricultural Extension Service. The Texas A&M University System. <http://gallus.tamu.edu/biofac.html>.

3) Jeffrey, Joan S., DVM. *Biosecurity for Exotic Fowl.* (1999). 18 May 1999. Texas Agricultural Extension Service. The Texas A&M University System. <http://gallus.tamu.edu/ratite/biosecur.html>.

4) *Poultry Manure Management Planning (ID-206).* (1994). 18 May 1999. Cooperative Extension Service, Purdue University. West Lafayette, IN. <http://www.agcom.purdue.edu/AgCom/Pubs/ID-206.html>.

5) *Viral Diseases.* (1997).18 May 1999. Cooperative Extension Service. Mississippi State University. <http://www.msstate.edu/dept/poultry/disviral.htm>.

d. Other References (available from Missouri Resource Center for Career & Technical Education (MRCCTE), 1-800-392-7217, formerly MVRC, University of Missouri-Columbia)

1) *Poultry Learning Lab Interactive CD-ROM.* Curriculum Materials Service. The Ohio State University, Columbus, OH, 1997.

Introduction to Poultry Production - Competency Crosswalk

Duty Band and Task Statement	SHOW-ME STANDARDS		CURRICULUM FRAMEWORKS					
	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health/ Physical Education	Fine Arts
1	CA-3	1.2, 1.3, 1.4, 1.7, 1.8, 1.10, 2.b, 3.1, 3.2, 3.5		CA/I/9-12/1b, 1d, 2c CA/III/9-12/1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i				FA/IV-A/9-12/6a
2	CA-1 HPE-6	1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.7		CA/I/9-12/1b, 1d, 2c CA/III/9-12/1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i			HPE/III-D/9-12/1a	
3	HPE-6 SC-8 CA-3 HP-3	1.2, 1.3, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 4.7		CA/I/9-12/1b, c/2c CA/IV/9-12/1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i	SC/VIII-B/9-12/1a, 2a, 2b, 2c		HPE/III-D/9-12/1a	
4	CA-3 SC-3	1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7		CA/I/9-12/1b, 1d, 2c CA/IV/9-12/1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i	SC/VIII-A/9-12/1a, 2a SC/VII-D/9-12/2a, 3a			
5	SC-8 HPE-3 CA-3	1.2, 1.3, 1.4, 1.5, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.7		CA/I/9-12/1b, 1d CA/IV/9-12/1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i	SC/VIII-B/9-12/1a, 2a, 2b, 2c		HPE/III-A/9-12/1, 9, 11, 12a	
6	CA-3 HPE-3 SS-4	1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8		CA/I/9-12/1b, 1d CA/IV/1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i		SS/IV-D/9-12/1, 2, 3, 4/f, g, h, j, k, l, n, o	HPE/III-A/9-12/1a, 9a, 11a, 12a	

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Introduction to Poultry Producton
Competency Profile

Directions: Evaluate the student by checking the appropriate number or letter to indicate the degree of competency. The rating for each task should reflect **employability readiness** rather than the grades given in class.

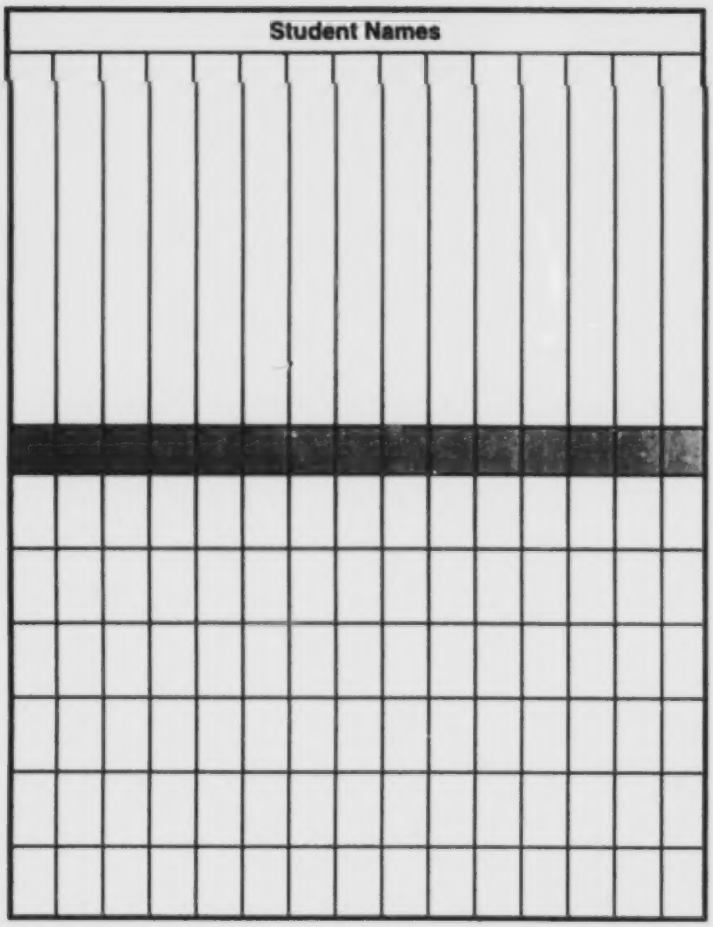
Rating Scale:
3 Mastered - can work independently with no supervision
2 Requires Supervision - can perform job completely with limited supervision
1 Not Mastered - requires instruction and close supervision
N No Exposure - no experience or knowledge in this area

3	2	1	N

Introduction to Poultry Production

1. Describe the importance of the poultry industry in Missouri.
2. Select and evaluate poultry.
3. Describe poultry production and management systems.
4. Explain poultry reproductive processes.
5. Identify poultry flock health issues.
6. Identify procedures involved in processing poultry products.

Introduction to Poultry Production



Competencies

1. Describe the importance of the poultry industry in Missouri.
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UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 1: Overview of the Poultry Industry

Competency/Objective: Describe the importance of the poultry industry in Missouri.

Study Questions

1. **What is poultry?**
2. **What is the economic importance of Missouri's poultry industry?**
3. **How has the poultry industry evolved?**
4. **What are the common breeds and production lines of poultry?**
5. **What are the types of poultry enterprises?**
6. **What career opportunities are available in the poultry industry?**

References

1. *Introduction to Poultry Production* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1999.
2. Activity Sheet
   a) AS 1.1: Identify Poultry Class Traits

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 1: Overview of the Poultry Industry

TEACHING PROCEDURES

A. ***Introduction***

The poultry industry has a tremendous impact economically in Missouri and in the United States, particularly in the southeast part of the country. The industry has changed significantly in the last 30 years. This lesson will discuss the history and economic impact of the poultry industry, the types of breeds and enterprises, and career opportunities within the industry.

B. ***Motivation***

1. Set up an incubator system within the classroom 5 to 10 days prior to the start of class so that the chicks will be ready to hatch before the completion of this unit. Use good quality, fresh, fertile eggs that were laid within the past three or four days. Refer to University of Missouri Agricultural Extension Publication G8353 *Small Flock Series: Incubation of Poultry.*

2. Have a guest speaker that works within the poultry industry come talk to the class. Ask the speaker to describe his/her role and give a personal perspective on the industry as a whole.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Ask the students what birds they think should be included in the definition of poultry. Write the list on the board. Discuss their reasons for including these birds in their definition of poultry.

What is poultry?

a) Poultry are economically important birds used either for food or show; includes chickens, turkeys, pheasants, partridges and peafowl, and to some extent quail, ducks, geese, and guineas.
b) Vocabulary
   1) Pullet -a young female chicken
   2) Hen - a sexually mature female chicken, usually more than 10 months old, that has started to lay eggs
   3) Chick - a baby chicken of either gender
   4) Broiler or fryer - a young male or female chicken, tender-meated with breastbone cartilage, marketed at 6 to 8 weeks of age
   5) Roaster - a young male or female chicken, tender-meated with breastbone cartilage somewhat less flexible than a broiler or fryer, usually marketed at 7 to 10 weeks of age
   6) Capon - a surgically unsexed male chicken, usually under 8 months old, used for specialty markets
   7) Cockerel - a male chicken less than one year old
   8) Rooster - a sexually mature male chicken
   9) Poult - a male or female baby turkey

2. Obtain the most recent copy of the *Missouri Farm Facts*, which can be obtained from the Missouri Department of Agriculture. (The statistics in this text were taken from the 1998 issue.) Discuss the economic impact the poultry industry has in Missouri and throughout the country. Determine which states produce the most turkey, broilers, hens, and eggs.

What is the economic importance of Missouri's poultry industry?

a) Turkey production
   1) In 1997, Missouri ranked 5th in the United States for turkey production, 22 million head, 7.3 percent of the U.S. total.
   2) 1997 total value of production equals $236 million.
b) Broiler production
   1) Missouri ranks 10th for broiler production at 250 million head, 3.2 percent of U.S. total.
   2) 1997 total value of production equals $403 million.
c) Egg production
   1) Missouri ranks 14th for egg production at 1.7 million, 2.2 percent of total U.S. production.
   2) 1997 total value of production equals $85 million.
d) All chickens (except broilers)
   1) Missouri ranks 15th for chicken production at 9.5 million head, 2.3 percent of total U.S. production.
   2) 1997 total value of sales equals $1.6 million.
e) Poultry and eggs accounted for 27 percent of total livestock cash receipts in Missouri in 1997.
f) Meat animals accounted for 60 percent of total livestock cash receipts in Missouri in 1997.
g) Total pounds of broiler meat produced was 1,075,000 pounds in 1997 in Missouri.
h) Total pounds of turkey meat produced was 589,600 pounds in 1997 in Missouri.
i) Provides many people with careers in production and marketing.
j) Manufacturing companies support enterprises with equipment and facilities.

3. Discuss the differences between the poultry industry of the past and the large enterprises that exist today. Ask the students how many times a week they eat a poultry product and tie this in with the increase in demand from consumers for poultry products.

How has the poultry industry evolved?

a) Early settlers with small backyard flocks were considered small farm enterprises.
b) In the 1800s farmers began to specialize in poultry production; poultry shows began in the 1850s.
c) The American Poultry Association was founded in 1873. The publication of *American Standards of Perfection* was created in 1874 to establish standards for showing birds.
d) Highly specialized industry with the southeastern and midwestern part of the U.S. being the overall largest producers of poultry.
e) Major types of poultry enterprises
   1) Egg production
      (a) Number of laying hen farms has decreased, but the size of farms and flocks has grown significantly.
      (b) Decrease in total number of laying hens, but egg production has been steady due to an increased rate-of-lay per hen.
      (c) Decrease in egg consumption per person due to alternative breakfast foods and problems with cholesterol.
   2) Broiler production and turkey production
      (a) Broiler and turkey sales have skyrocketed since late 1960s.
         (a) In past five years, broilers have increased $189 million in sales.
         (b) In past five years, turkeys have increased $57 million in sales.
      (b) Increase in consumption due to processing into other products and the small amount of cholesterol found in broilers and turkeys.
   3) Replacement pullets, broiler chicks, and poults
      (a) Broiler chicks and poult production facilities typically located close to production facility
      (b) Breeder flocks somewhat isolated from production farms
      (c) Hatcheries incubate fertilized eggs, hatch, and deliver chicks and poults

(d) Some hatcheries provide vaccinations, egg injections, beak trimming
(e) Pullets and turkeys are sexed at the hatchery

4. Review common poultry terms used when referring to breeds and production lines. Acquaint the students with common breeds and strains of poultry used for egg-laying, broilers, and turkeys. Point out which breeds and strains produce white eggs and which produce brown eggs.

What are the common breeds and production lines of poultry?

a) Poultry is divided into breeds, varieties, types and classes.
   1) Breed - group of birds that share the same characteristics and have a common origin.
   2) Variety - a subdivision of a breed that is based on a group of specific traits, such as color or comb shape.
   3) Type - describes the purpose for which the bird is used, egg-type or meat-type.
   4) Class - associates the bird with its place of origin; the general classes are Mediterranean, American, English, and Asiatic.
b) Strains are families or breeding populations possessing common traits.
   1) Strain shows relationship more exacting than for others of similar appearance
   2) Strain crossing refers to crossing of different strains of the same variety
   3) Many commercial strains exist: Cobb, Hubbard, DeKalb, Hyline, Babcock, Shaver
c) *American Standard of Perfection* catalogs more than 300 different breeds and varieties
d) Most breeds of poultry are a product of cross mating, crossbreeding, or inbreeding.
   1) Cross mating involves mating birds within the same breed.
   2) Crossbreeding is mating birds of different breeds or varieties.
   3) Inbreeding is mating birds that are closely related to get specific traits.
e) Common egg producing breeds
   1) Common white-egg layer hen - Single Comb White Leghorn
   2) Smaller flock owners raise dual-purpose brown egg-producing strains
f) Broilers
   1) Most common meat producer is a cross between the male Cornish (English class) and the female White Plymouth Rock (American class).
   2) This cross has low rate of egg production but efficient in meat production.
g) Strains of turkeys
   1) Typically referred to as their strain name rather than variety name
   2) Common commercial strains: Broad-Breasted Large White, Beltsville Small White, Nicholas, and British United Turkey (BUT)

5. Ask students how many birds they would need to raise to be considered a "commercial enterprise". If they have birds, but are not considered a commercial enterprise, then what type of enterprise would they be?

What are the types of poultry enterprises?

a) Commercial enterprises
   1) Three types: egg production, broiler or turkey production, and pullets and poults raised for replacement
   2) Vertical integration means that one enterprise owns and controls more than one type of production operation.
      (a) Run by poultry processors or manufacturers who are in charge of most management decisions and problem solving.
      (b) Almost all meat production and 50 percent of egg production are under this system.
      (c) Most products are sold under a brand name, such as Tyson, Holly Farms, Cargill, or Con-Agra.
   3) Commercial broiler fowl, laying hens, and turkeys are produced by genetic companies that own breeding fowl.
      (a) Incubate and hatch layer and broiler chicks.

(b) Provide producers with the bird, vaccinations, feeding, lighting, and pullet growing program.
(c) Veterinary and technical field services provided by company.

4) Laying hen facilities raise birds in quantities of 100,000 or more.
(a) Raise hens in cages in environmentally controlled housing.
(b) Specific lighting, ventilation, feeding programs, and automated egg collection.

5) Commercial broiler fowl are not commonly raised in automated confinement systems to avoid leg problems and breast blistering.

b) Backyard enterprises raise their own birds for eggs and meat.
1) Requires minimal amount of space and provides fresh eggs and meat.
2) Popular dual-purpose breeds are Rhode Island Red, Plymouth Rock, New Hampshire, Wyandotte, and Orpington.

c) Niche market enterprise produces eggs and meat in an alternative or "organic" manner.
1) Organic refers to products produced free of synthetic chemicals and drugs.
2) Standards exist but vary from state to state.
3) USDA Ag Marketing Service developing National Organic Program.

6. Ask the students to identify different employment opportunities based on what they have already learned about the poultry industry. List these careers on the board or overhead transparency.

What career opportunities are available in the poultry industry?

a) The poultry industry provides careers from marketing to research.
b) Industry has grown dramatically and systems have become very specialized.
c) Developing technology and research creates employment opportunities and many specialized jobs.
d) Occupations that require training and/or certification - chick sexer, artificial insemination technicians, blood testers, sanitation workers.
e) Occupations that require a college degree - poultry breeding, field service personnel, waste systems managers, personnel officers, accountants.
f) Occupations that require an advanced degree - poultry scientist, geneticist, or veterinarian.

F. ***Other Activities***

1. Have students research different breeds in the *American Standard of Perfection* and prepare short oral reports that describe breed characteristics and standards.

2. Have students research and construct a time line of the development of the poultry industry in the United States and Missouri.

3. One designated student can contact a local poultry producer where they can talk with human resource personnel about the range of jobs available. If there is not a poultry plant in the community, contact The Poultry Federation (TPF). Have the student share this information with the class.

4. Show pictures, slides, or videos of different breeds. Available for loan from Missouri Resource Center for Career and Technical Education (MRCCTE) (formerly MVRC) *Poultry Learning Lab Interactive CD-ROM* published by Curriculum Materials Service, The Ohio State University.

G. ***Conclusion***

The poultry industry has changed dramatically in the last 30 years as consumption of meat products has increased and rate-of-lay has improved. Poultry is a group of birds considered economically important (i.e. layers, broilers, and turkeys). The industry, and in particular turkey production, is very important to the economy of Missouri. The three different poultry enterprises are commercial, backyard, and niche market. A common breed in the commercial market is the Single Comb White Leghorn for egg production and a cross of the male Cornish with the female White Plymouth Rock for meat production. The common turkey strain used for meat is the Broad Breasted Large White. There are

many employment opportunities in the poultry industry, which is another reason why the industry is so important for Missouri.

H. ***Answers to Activity Sheet***

Suggested references that can be used for this activity sheet include:
Standard of Perfection, published by the American Poultry Association (A.P.A.)
Introduction to Avian Bowl, Clemson University, Clemson, SC

Class	Color of Skin	Color of Ear Lobe	Feathered Shanks	Egg Color
American	Yellow	Red	No	Brown
Asiatic	White & Yellow	Red	Yes	Brown
English	White & yellow	Red	No	Brown & White
Mediterranean	White & Yellow	White	No	White

I. **Answers to Evaluation**

1. g
2. d
3. f
4. c
5. e
6. a
7. i
8. b
9. j
10. h
11. b
12. c
13. a
14. Poultry is any group of birds that are economically important, either for food or show.
15. One of the following: cholesterol awareness, further processing
16. Egg, broiler, turkey, replacement pullets
17. Cross mating, Crossbreeding, Inbreeding
18. Broad-breasted Large White, Beltsville Small White, Nicholas, British United Turkey.
19. This breed has been bred for superior meat production and has very low egg production. Dual breeds would be a better choice. Any of the following dual breeds are appropriate: Rhode Island Red, Plymouth Rock, New Hampshire, Wyandotte, or Orpington.
20. Any three of the following careers: artificial insemination technician, blood testers, sanitation workers, poultry breeding, field service personnel, waste systems managers, personnel officers, accountants, poultry scientist or geneticist, veterinarian.

UNIT - INTRODUCTION TO POULTRY PRODUCTION Name_____

Lesson 1: Overview of the Poultry Industry Date_____

EVALUATION

Match the terms with the definitions.

1. ____ A male or female baby turkey.
2. ____ A chicken marketed for meat at 6 to 8 weeks.
3. ____ A young female chicken.
4. ____ A male chicken less than one year old.
5. ____ A sexually mature female chicken that has started to lay eggs.
6. ____ Group of birds that share same characteristics and have a common origin.
7. ____ Describes the purpose for which the bird is used.
8. ____ Associates the bird with its place of origin.
9. ____ Based on specific traits such as color or comb shape.
10. ____ Total lifetime egg production of a hen.

a. Breed
b. Class
c. Cockerel
d. Broiler
e. Hen
f. Pullet
g. Poult
h. Rate-of-lay
i. Type
j. Variety

Circle the letter that corresponds to the best answer.

11. According to the 1998 issue of *Missouri Farm Facts* quoted in the text, Missouri ranks 5th in the United States for production of

    a. Broiler
    b. Turkey
    c. Egg
    d. Quail

12. What is the most common white egg layer hen?

    a. Rhode Island Red
    b. Beltsville Small White
    c. Single Comb White Leghorn
    d. New Hampshire

13. Families or breeding populations possessing common traits are referred to as a:

    a. Strain.
    b. Cross mating.
    c. Crossbreeding.
    d. Inbreeding.

Complete the following short answer questions.

14. Describe "poultry" to a person who does not know what types of birds are included in this definition.

15. Name one reason there has been an increase in turkey and broiler meat consumption in the last 30 years.

16. What are the four major commercial enterprises that make up the poultry industry?

    a.

    b.

    c.

    d.

17. What breeding methods are used for chickens that are bred for meat and eggs?

    a.

    b.

    c.

18. List four common commercial turkey production strains.

    a.

    b.

    c.

    d.

19. In a backyard dual-purpose poultry operation, why would it not be wise to use a cross between the male Cornish and the female White Plymouth Rock? Name one other option for birds that would be a better choice? Why?

20. Name three jobs or careers in the poultry industry.

    a.

    b.

    c.

Lesson 1: Overview of the Poultry Industry Name_____

Identify Poultry Class Traits

Objective: Student will become familiar with the different traits of poultry classes.

Research the different types of classes or breeds to determine the color of skin, color of the ear lobe, whether the shanks have feathers, and the color of the egg produced. Your instructor will give you suggested references to review to determine this information.

Class	Color of Skin	Color of Ear Lobe	Feathered Shanks	Egg Color
America				
Asiatic				
English				
Mediterranean				

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 2: Selection and Evaluation

Competency/Objective: Select and evaluate poultry.

Study Questions

1. **What are the parts of poultry?**
2. **What are the characteristics for broiler breeder poultry selection?**
3. **What are the characteristics of turkey breeder selection?**
4. **What are the characteristics for selection of commercial layers and pullets?**
5. **What is the proper way to handle poultry during evaluation?**

References

1. *Introduction to Poultry Production (Student Reference).* University of Missouri-Columbia: Instructional Materials Laboratory, 1999.
2. Transparency Masters
   a) TM 2.1: Parts of a Chicken
   b) TM 2.2: Parts of a Turkey
3. Activity Sheets
   a) AS 2.1: Identify Parts of a Chicken
   b) AS 2.2: Identify Parts of a Turkey

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 2: Selection and Evaluation

TEACHING PROCEDURES

A. ***Review***

Properly selecting poultry is very important to maintain high quality birds in the industry. Choosing a better bird will achieve overall improvement of the flock. This lesson will define the terminology of bird parts. It is important to become familiar with industry terms to better understand how to select and evaluate quality.

B. ***Motivation***

Have available for the class two different birds of the same species with different health and productivity characteristics. Let the students visually observe the two birds to determine which is a better producer and which appears healthier. Discuss factors that influenced their decision. If live birds are not available, use pictures or transparencies to show different birds. Let the students determine which birds are examples of healthy and productive birds and which are not.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Familiarize the students with the terminology to identify parts of the chicken and the parts of the turkey. Many of these terms will be used when discussing the selection and evaluation of poultry. Refer to transparencies TM 2.1 for a diagram of chicken parts and TM 2.2 for a diagram of turkey parts.

What are the parts of poultry?

a) Parts of a chicken

1) Head
2) Comb
3) Beak
4) Wattle
5) Neck
6) Neck plumage
7) Neck feathers
8) Wing front
9) Breast
10) Wing bow
11) Wing coverts
12) Thigh
13) Lower thigh plumage
14) Toenails
15) Web
16) Toes
17) Foot
18) Shank
19) Rear body feathers
20) Primaries
21) Secondaries
22) Cushion
23) Main tail feathers
24) Tail coverts
25) Back
26) Cape
27) Ear lobe
28) Ear

BEST COPY AVAILABLE

b) Parts of a turkey

1) Head
2) Eye
3) Snood
4) Nostril
5) Beak
6) Fleshlike process
7) Wattles
8) Neck
9) Caruncle
10) Breast
11) Secondaries
12) Beard
13) Keel
14) Legs
15) Shank
16) Toes
17) Spur
18) Hock joint
19) Tail
20) Tail coverts
21) Wing coverts
22) Saddle
23) Back
24) Wing Bow
25) Shoulder
26) Cape
27) Ear

2. Discuss the economic importance of proper selection and culling of broiler poultry. Focus the discussion first on breeding, then on large commercial flocks, and finally on the backyard farm. Review the body parts that are important for evaluation of broiler breeders.

What are the characteristics for broiler breeder poultry selection?

a) Broiler breeders are the parent stock used to produce hatching eggs for commercial broiler production.
b) Factors used to determine a productive broiler breeder are general health, body weight, conformation, and performance data.
c) General health refers to indications of disease or abnormalities.
   1) Healthy bird
      (a) Very vocal
      (b) Eyes bright, rounded, and alert
      (c) Comb and wattles bright red, smooth, sturdy, waxy texture
      (d) Feathers around vent (posterior opening, anus) clean and dry
      (e) Body plumage close-fitting and clean
   2) Unhealthy bird
      (a) Sluggish behavior
      (b) Comb and wattles coarse, discolored, darker or lighter than normal
      (c) Feathers around vent dirty and damp
      (d) Feathers disarrayed
d) Body weight of offspring similar to weight of broilers' parents at seven weeks. Select only the larger birds at seven week evaluation.
e) Conformation refers to the general shape of the bird.
   1) Preferred shape
      (a) Crescent-shaped back, broad-breast, upright head
      (b) Feathers should lay well, be close-fitting, smooth, and unbroken
      (c) Pinfeathers present and just coming through or still under the skin
   2) Poor conformation
      (a) Wedge-shaped body, hunched-back, crooked breasts, backs, and legs.
      (b) Twisted feathers, broken quills, bare spots on the skin.
      (c) Too many pinfeathers cause difficult removal during processing.
   3) Fleshing refers to the commercially important muscles
      (a) Quality shape with thick, rounded breasts, good tone down the length of the vertebrae, thick meaty legs
      (b) Poor quality with inverted breast that comes to a point at the keel, thin legs and back
   4) Fat cover
      (a) Good fat cover is determined by pinching the skin of the abdomen; hardness indicates fat.

(b) Poor fat cover is indicated by thin skin over the abdominal area, where the thigh is connected to the breast, under areas of heavy feathers; when pinching the abdomen, softness indicates little fat.

5) Degree of defects
   (a) Defects result in downgrading.
   (b) Defects include: insect bites, bruises, callouses or blisters on the breast, bare areas and discolorations.
   (c) Defects can also be caused by improper handling.
6) General disqualifications
   (a) Black feathers found in cockerels
   (b) Green or black pigment found on the shanks
   (c) Crooked toes (greater than 90 degree bend)
   (d) Swollen hock joints
   (e) Infected foot pads

f) Performance data measured by growth rate.
   1) Rapid growth reduces time to market and results in savings in feed consumption.
   2) Positive growth rate reflects good breast width, body depth, and fleshing.

3. Discuss how turkey breeder selection is different from broiler breeder selection. Ask the students to compare the different birds and their body parts.

What are the characteristics of turkey breeder selection?

a) Criteria for turkey selection is similar to broiler breeder selection.
b) Conformation important because turkey carcasses are often marketed whole and at higher weights.
c) Unhealthy turkey may have sagging caruncles. Caruncles are the fleshy protuberances on the naked portions of the head, face, and neck.

4. Discuss what a producer might look for in a commerical layer. Compare egg layers and pullets to meat-producing birds. Discuss the differences.

What are the characteristics for selection of commercial layers and pullets?

a) Selected and evaluated by pigmentation, general health, and conformation.
b) Pigmentation is the loss of color and is referred to as bleaching.
   1) Layers loose yellow pigmentation from the skin and shanks as they lay eggs.
   2) Pigmentation loss is a determining factor in the approximate number of eggs laid.
   3) Bleaching occurs in this order: vent, eye ring, ear lobe, beak (corner of the mouth toward the tip), bottom of the feet, loss from front, back, and sides of shank, hock and top of toes.
c) General health
   1) Productive hen
      (a) Comb and wattles bright red, waxy, smooth, and full
      (b) Bright, round eyes
      (c) Eye lids and eye rings are bleached
      (d) Beak bleached or in process of bleaching
      (e) Supple and moist vent, fully bleached
   2) Unproductive hen
      (a) Comb and wattles scaly, small, and discolored
      (b) Eyes droopy and sunk in
      (c) Beak yellow
      (d) Vent dry and yellow
d) Conformation determines high rate-of-lay.
   1) A quality hen
      (a) Broad head, smooth face
      (b) Large body capacity
      (c) Soft and flexible abdomen

(d) Supple skin
(e) Flat, smooth shanks
(f) Pubic bone thin, flexible, and spread wide enough to fit two to four fingers between them

2) Poor conformation
(a) Long, crow-shaped head
(b) Thin back
(c) Poor body capacity
(d) Hard abdomen
(e) Leathery skin
(f) Round, scaly shanks
(g) Pubic bones close together and inflexible

e) Pullets are sexually mature chickens less than 22 weeks old.
1) Selected by potential for high production in the future
2) Good comb and head development show signs of reaching sexual maturity.
3) No sign of disease in healthy pullet
4) Eyes round and prominent with smooth head of a normal color
5) Strong, wide back; broad body; roomy heart girth
6) Smooth feathers with no bare spots
7) Skin color on the shanks normal for breed
8) Legs straight and even with no abnormalities in the feet and toes

5. Explain the importance of proper handling of birds to avoid defects and injuries. Demonstrate the proper way to handle a live chicken (if possible). Discuss why handling is necessary to accurately evaluate the quality of the bird.

What is the proper way to handle poultry during evaluation?

a) Provides ability to observe areas of the bird not observable from a standing position.
b) Good control of the bird is necessary to reduce chance of getting away and causing injury.
1) Put one hand on the back of the bird and gently pin the bird down.
2) Slide the other hand under the breast and rest in palm.
3) Place hand on back to hold wings down and steady the bird.
4) Place index finger between hocks.
5) Place thumb around one leg and fingers around the other leg.
6) Gently lift bird while keeping hand on back.
7) Hold bird's head down with back resting against examiner's stomach.
(a) Allows observation of the vent, abdominal capacity, bleaching of feet and shanks.
(b) Pubic bones and softness of abdomen can be felt.
(c) Place fingers between keel bone and pubic bones to measure capacity.
(d) To check for molting, tuck hen under elbow and gently open the wing and count the feathers.
8) Return the bird to the coop with the breast in the palm and fingers holding the legs.
9) Place the bird in head first.
10) Be sure both feet are completely on the floor before releasing.

F. ***Other Activities***

1. Practice handling birds according to guidelines.

2. Let students select and evaluate quality birds from either live birds, if available, or photographs.

G. ***Conclusion***

Selection is very important to improving flocks. Broiler breeders and turkeys are selected for general health, body weight, conformation, and performance data. Commercial layers are selected for pigmentation, general health, and conformation. Pullets are selected for their potential to be highly

productive laying hens, as well as general health and conformation. Handling techniques are very important in the selection and evaluation of birds to avoid injury and potential defects.

H. ***Answers to Activity Sheet***

AS 2.1

1. Head
2. Comb
3. Beak
4. Wattle
5. Neck
6. Neck plumage
7. Neck feathers
8. Wing front
9. Breast
10. Wing bow
11. Wing coverts
12. Thigh
13. Lower thigh plumage
14. Toenails
15. Web
16. Toes
17. Foot
18. Shank
19. Rear body feathers
20. Primaries
21. Secondaries
22. Cushion
23. Main tail feathers
24. Tail coverts
25. Back
26. Cape
27. Ear lobe
28. Ear

AS 2.2

1. Head
2. Eye
3. Snood
4. Nostril
5. Beak
6. Fleshlike process
7. Wattles
8. Neck
9. Caruncle
10. Breast
11. Secondaries
12. Beard
13. Keel
14. Legs
15. Shank
16. Toes
17. Spur
18. Hock joint
19. Tail
20. Tail coverts
21. Wing coverts
22. Saddle
23. Back
24. Wing Bow
25. Shoulder
26. Cape
27. Ear

I. ***Answers to Evaluation***

1. d
2. a
3. f
4. b
5. g
6. c
7. e
8. Any of the following three: general health, body weight, conformation, performance data.
9. Conformation is most important because the turkey carcasses are often marketed whole and at higher weights.
10. Bleaching is the loss of pigment or color. By observing the amount of pigment in certain areas, one can determine whether the hen is productive.
11. The bird should be held facing the examiner with the head under the elbow.
12. The bird should be released head first with both feet completely on the floor before release.

UNIT - INTRODUCTION TO POULTRY PRODUCTION Name_____

Lesson 2: Selection and Evaluation Date_____

EVALUATION

Match the terms with the definitions.

____	1. Evaluated at seven weeks.	a.	Conformation
____	2. The general shape of the bird.	b.	General health
____	3. Commerically important muscles.	c.	Defects
____	4. Indications of disease or abnormalities.	d.	Body weight
____	5. Measured by the growth rate.	e.	Pigmentation
____	6. Result in downgrading of the meat.	f.	Fleshing
____	7. Determines whether hen is productive.	g.	Performance data

8. Name three factors important in selecting a quality broiler breeder.

   a.

   b.

   c.

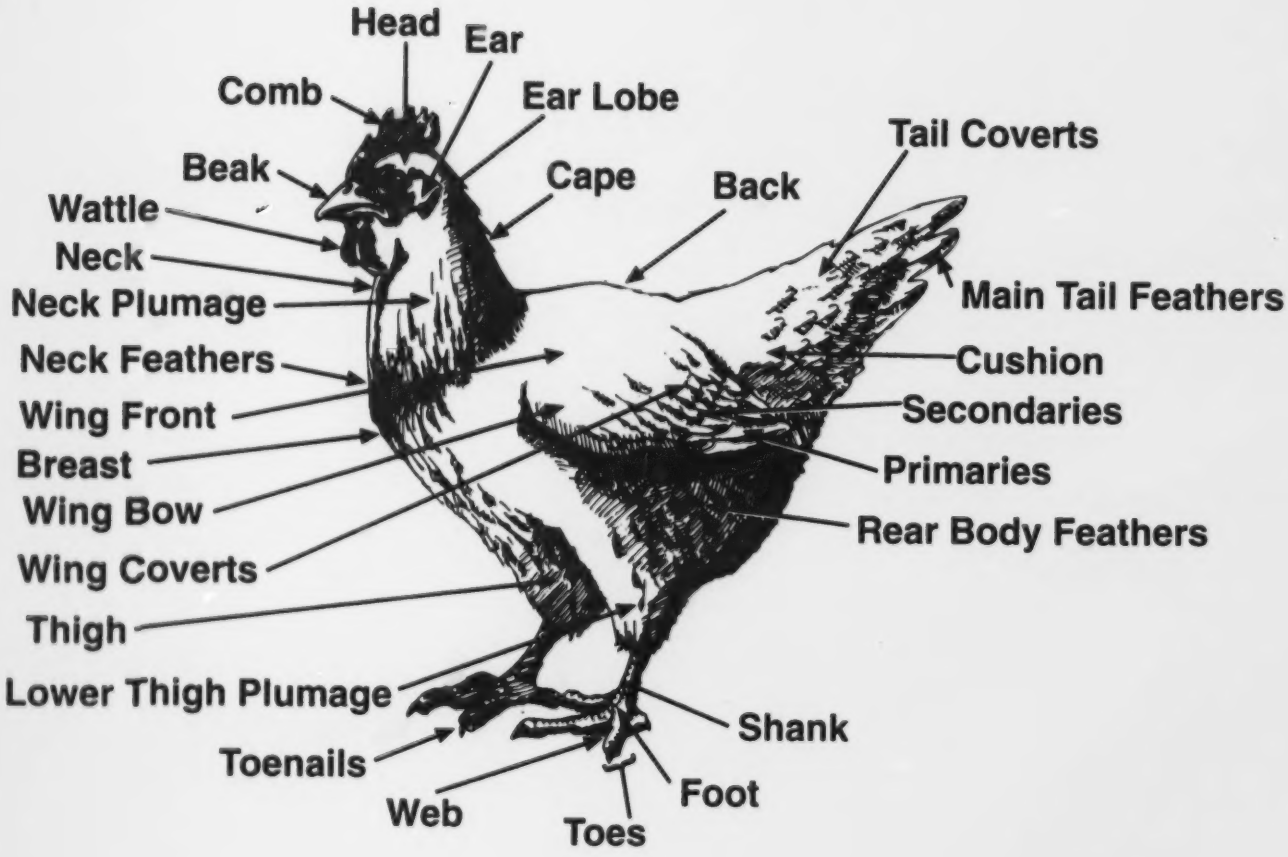
9. What factor in turkey selection is more important than in broiler breeder selection? Why?

10. What is bleaching and why is it important in determining past production of laying hens?

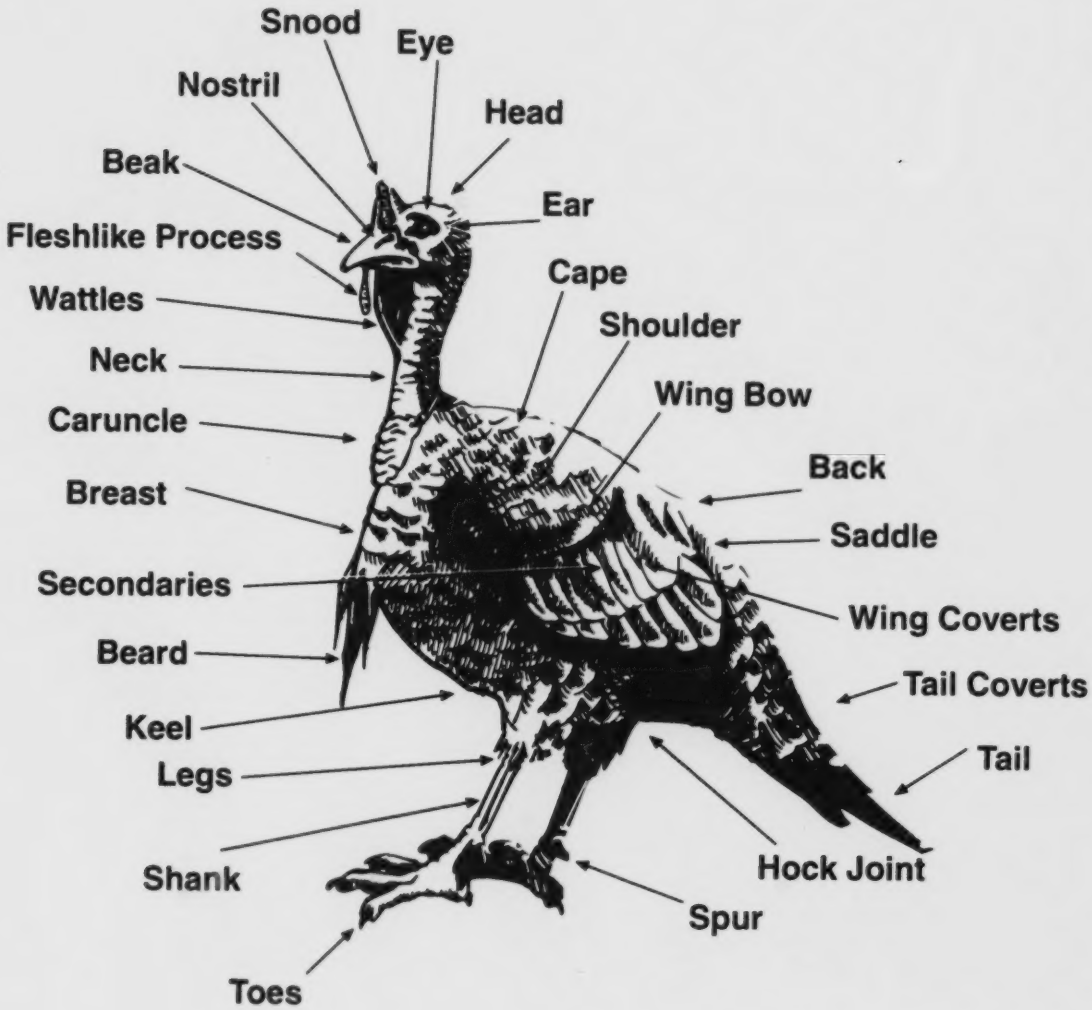
11. When handling a bird for evaluation, how should the bird be positioned when measuring the abdominal width?

12. How should the bird be released?

Parts of a Chicken



Parts of a Turkey



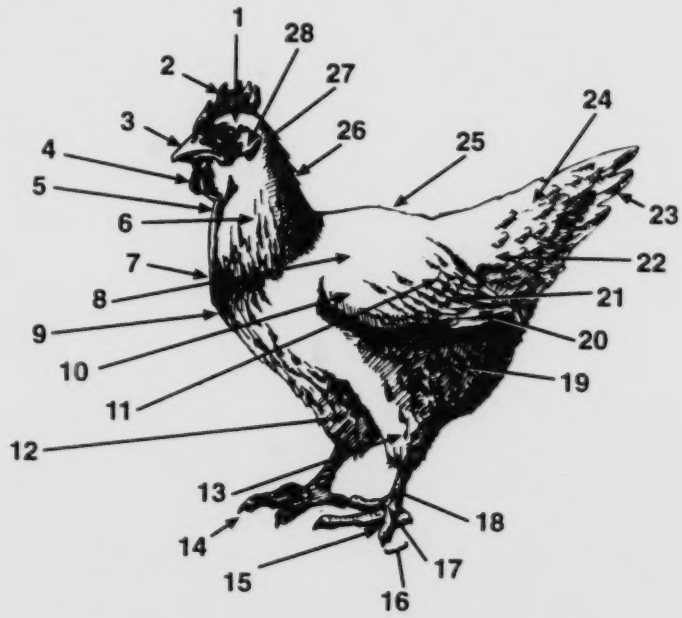
Lesson 2: Selection and Evaluation Name_____

Identify Parts of a Chicken

Objective: Students will identify the parts of a chicken.

Label the following picture with the corresponding body parts for a chicken.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____



24. _____
25. _____
26. _____
27. _____
28. _____

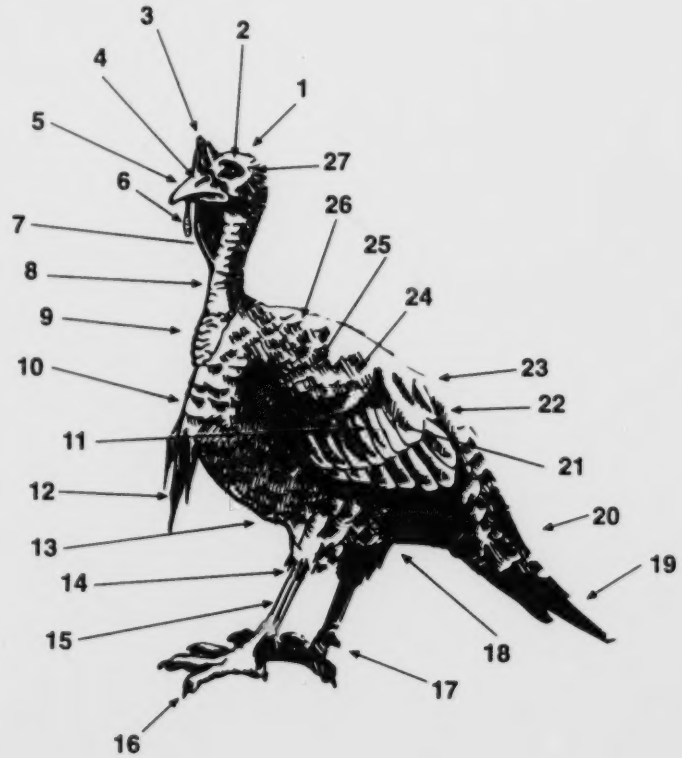
Lesson 2: Selection and Evaluation Name_____

Identify Parts of a Turkey

Objective: Students will identify the parts of a turkey.

Label the following picture with the corresponding body parts for a turkey.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____



24. _____
25. _____
26. _____
27. _____

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 3: Production

Competency/Objective: Describe poultry production and management practices.

Study Questions

1. **What are the different types of commercial poultry production systems?**
2. **What facilities and equipment are required for poultry production systems?**
3. **What are the nutritional requirements of broilers, layers, turkeys, and pullets?**
4. **How are poultry production wastes and by-products utilized and managed?**

References

1. *Introduction to Poultry Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1999.

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 3: Production

TEACHING PROCEDURES

A. ***Review***

The previous lessons introduced the types of poultry and the selection, evaluation, and handling of poultry. This lesson will review production systems and facilities for the major commercial enterprises. Poultry use nutrients differently than other livestock and their nutritional requirements are a vital component of their health and growth. The waste and by-products produced by poultry need to be handled properly to avoid pollution of water resources.

B. ***Motivation***

Ask the students to brainstorm ideas about what factors they think would be important in poultry production systems. They should include facility layout, equipment, nutritional needs, and waste management. List their ideas on the board. Students that have small poultry operations at home may bring up ideas that may be used in small operations. Ask the class how this might compare to large commercial operations.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. The four major commercial enterprises are discussed: broiler production, turkey production, egg production, and pullet production for replacement purposes. Generally, they all have integrated or contract operations. Discuss vertical integration systems and how each production process fits into this system.

   What are the different types of commercial poultry production systems?

   a) Vertical integration - Two or more stages of the production, processing, and distribution are controlled by a single firm.
   b) Broiler production
      1) Well-suited to assembly line techniques.
      2) Integrated system is typical with 99 percent of broilers produced under contract.
         (a) Integrated contractor provides chicks, feed, processing, vaccinations, supervision, and transportation.
         (b) Producer/grower provides housing, grow-out equipment (feeders, waterers, and brooder houses), utilities, labor, and management.
      3) Highly automated for feeding, watering, lighting, and ventilation.
      4) Slaughter operations are regulated by state and federal inspections.
   c) Turkey production
      1) Trend of fewer but larger farms and processing plants
      2) Traditionally range raised
      3) Trend towards confinement rearing with highly automated feeding and watering systems
      4) Typically grown under contract
   d) Layers for egg production
      1) Fewer but larger flocks.
      2) Maximum egg production at minimum costs.
      3) High-producing strains produce average 285 to 310 eggs over 12 to 14 month laying cycle.

4) Produced primarily on integrated or contract arrangement.

e) Replacement pullets
   1) Raised by egg producers or purchased from hatcheries
   2) Raised on floors, in cages, or combination
   3) Sanitation very important to avoid diseases
   4) Should not mix ages and strains in same house

2. Discuss the facilities and equipment needed in each of the major commercial production systems. Include in the discussion the temperature, moisture, ventilation, and lighting needs for each type of production area.

What facilities and equipment are required for poultry production systems?

a) Small chicks start out in brooder houses.
   1) Special heating equipment needed to keep chicks warm until well-feathered
   2) Small, trough-type feeding and watering equipment suitable for day-old chicks
   3) No drafts on floor
   4) Lighting provided by heating equipment or room lights

b) Pullets
   1) Raised in same house used for brooding or moved to separate housing
   2) Grown in partial cage system or complete cage system
      (a) Partial cage starts pullets on floor first 6 to 10 weeks, then moved to cages.
      (b) Complete cage system grows pullet completely in cage.
   3) Lighting regulated because it affects sexual maturity rate of pullet
   4) Feeders and waterers placed in convenient locations

c) Layers
   1) Housed in caged systems, open- or slat-floor systems
      (a) Cage systems typically multiple-bird cages that hold 5 to 10 birds
      (b) Open-or slat-floor systems
         (1) Result in dirty or broken eggs
         (2) Stress to hens competing for food
         (3) Extra cost for litter
         (4) More labor to collect eggs by hand
   2) Adequate temperature and ventilation required
   3) Fresh, clean food and water provided automatically or by hand
   4) Lighting closely regulated
   5) Egg room needed to hold eggs for market

d) Broilers
   1) Typically raised in large confinement facilities
      (a) Single houses may hold 20,000 to 28,000 birds.
      (b) .75 or .8 square feet allowed per bird.
   2) Partial house brooding utilized with one end restricted until chick is three weeks old
      (a) Maintains and monitors heat available while chicks are young
      (b) Allowed full range of house when older
   3) Automated feed and water
   4) Natural and artificial lighting

e) Turkey poults
   1) Raised in clear-span, metal-roofed buildings
   2) Provide brooding, growing, finishing or combination of all steps
   3) Dirt floors covered with absorbent litter material

3. Discuss why nutritional needs of poultry is so vital to their growth and energy maintenance compared to other farm animals. Review the nutritional needs of poultry and what feed additives may be added to their diet.

What are the nutritional requirements for broilers, layers, turkeys, and pullets?

a) Birds use nutrients every hour of the day.

1) Digestion system very rapid
2) Respiration and circulation fast
3) Grow at a rapid rate
4) More sensitive to environmental influences
5) Body temperature higher than other farm animals
6) Mature at an earlier age

b) Birds are fed complex rations for maximum meat or egg production, fertility, and body maintenance.

c) Feed system is composed of five nutrient classes.
1) Energy (carbohydrates and fats)
(a) Provided by carbohydrates
(b) Powers the movement of muscles and produces body heat
(c) Extra energy stored in the body as fat
(d) Sources include animal products (fats) and plant products (grains and vegetable oils)
2) Protein provides amino acids, which are the building blocks for cell growth.
3) Vitamins are made up of fat- or water-soluble organic substances.
(a) Aid in digestion, absorption, and metabolism
(b) Regulate formation and development of new cells
4) Minerals
(a) Inorganic elements.
(b) Help develop bones and eggshells
5) Water
(a) Helps to absorb nutrients from the digestive tract
(b) Aids in metabolic reactions

4. Discuss what is included in wastes and by-products of poultry. Review the management and disposal options and uses for the wastes and by-products.

How are poultry production wastes and by-products utilized and managed?

a) Manure, carcasses, and eggs are examples of wastes and by-products.
1) 30,000 laying hens can produce 40 tons of manure a month or nearly 500 tons a year.
2) Proper handling, storage, and application can protect water resources and increase profits of bird and crop enterprises.
3) Animal wastes are a source of plant nutrients for crop production.
4) Dried and processed manure is used as animal feed for other livestock.

b) Typical housing systems include cages above dry or liquid pits, floors with litter, and outdoor ranges.
1) Cages above dry or liquid pits
(a) Cages allow manure to fall to a pit or be scraped from boards below cages.
(b) Deep pit systems develop into solid manure if kept dry.
(c) Manure is scraped or flushed with water from pits directly into spreader or storage.
2) Floors with litter
(a) Remove caked manure from around waterers.
(b) Stir to increase drying.
(c) Add new litter.
(d) Tractor loaders remove manure-litter mixture periodically and pens cleaned and disinfected.

F. ***Other Activities***

1. Take a field trip or show a video on a commercial laying house and a broiler house. Compare the similarities and differences.

2. Take a field trip to an older broiler house or laying house. Have the students compare the two facilities.

G. ***Conclusion***

Vertical integration and contract systems have made commercial poultry production systems very specialized. The facilities and equipment have also become highly specialized with specific requirements for each production system. Nutritional requirements consisting of protein, energy, vitamins, minerals, and water are all included in mixed rations for the birds. Poultry waste and by-products are an important source of nutrients for crop production and provide a means of disposing of the waste.

H. ***Answers to Evaluation***

1. When two or more stages of the production, processing, and distribution are controlled by a single firm.
2. Temperature, moisture, ventilation, and lighting
3. Caged systems and open- or slat-floor systems. Cage systems are the most common. Open- or slat-floor systems result in dirty or broken eggs, competition for food, extra cost of litter, more labor to collect eggs.
4. Any three of the following: rapid digestion, fast respiration and circulation, grow at a rapid rate, more sensitive to environmental influences, body temperature is high, mature at an early age.
5. 6, 10
6. .75, .8
7. Turkey poults
8. Plant nutrients
9. Cages above dry or liquid pits, floors with litter, outdoor ranges
10. c
11. b
12. f
13. e
14. d

UNIT - INTRODUCTION TO POULTRY PRODUCTION Name_____

Lesson 3: Production Date_____

EVALUATION

Complete the following short answer questions.

1. Explain vertical integrations systems for the poultry industry.

2. What are the four major factors to consider in facility planning?

   a.

   b.

   c.

   d.

3. What are two types of housing systems used for layers? Which is the most common and why?

   a.

   b.

4. List three reasons poultry use more nutrients than other farm animals.

   a.

   b.

   c.

Fill in the blank in the following statements.

5. The partial cage system starts the pullets out on the floor for the first ____ to ____ weeks and then they are moved to cages.

6. Broilers are typically raised in large confinement facilities with ____ to ____ square feet allowed per bird.

7. _____ are raised in clear-span, metal-roofed buildings.

8. Animal wastes are an important source of _____ for crop production.

9. To manage waste, typical housing systems include _____,

   _____, and _____.

Match the terms in the left column with the statements in the right column.

10. _____	Powers movement of muscles and produces body heat.	a.	Water
11. _____	Aids in digestion, absorption, and metabolism.	b.	Vitamins
12. _____	Develop bones and eggshells.	c.	Energy
13. _____	Absorbs nutrients from the digestive tract and aids in metabolic reactions.	d.	Protein
14. _____	Provides amino acids for cell growth.	e.	Water
		f.	Minerals

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 4: Reproduction

Competency/Objective: Explain poultry reproductive processes.

Study Questions

1. **What are the parts of the male reproductive tract and their functions?**
2. **What are the parts of the female reproductive tract and their functions for developing an egg?**
3. **What are the parts of an egg?**
4. **How does an embryo develop into a fertile egg?**
5. **How does the reproductive process in poultry differ from other livestock?**

Reference

1. *Introduction to Poultry Production (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1999.
2. *Introduction to Animal Reproduction (Student Reference)*. University of Missouri-Columbia. Instructional Materials Laboratory, 1996.
3. Transparency Masters
   a) TM 4.1: Parts of Male Reproductive Tract
   b) TM 4.2: Parts of Female Reproductive Tract
   c) TM 4.3: Egg Parts
   d) TM 4.4: Embryo
4. Activity Sheet
   a) AS 4.1: Female Reproductive System and Egg Development

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 4: Reproduction

TEACHING PROCEDURES

A. ***Review***

The reproductive process in poultry is very different from other livestock. This lesson will familiarize the student with the male and female reproductive system and egg development. It will also review the formation and development of the embryo.

B. ***Motivation***

Dissect a raw and a hard-boiled egg. Discuss the different layers and their functions with the students.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Familiarize the students with the parts of the reproductive system of male poultry. Refer to TM 4.1 for a diagram to indicate the location of the parts.

   What are the parts of the male reproductive tract and their functions?

   a) Testicles
      1) Located along backbone within the abdominal cavity
      2) Two testicles made up of ducts that produce and secrete semen
      3) Connected to the vas deferens
   b) Vas deferens is a tube that transfers semen to the cloaca.
   c) Cloaca
      1) Common area where reproductive and digestive systems meet
      2) Holds the papillae within the folds of the wall
   d) Papillae transports the sperm to the female reproductive tract during mating.
   e) Vent
      1) Opening of the cloaca
      2) Releases the reproductive and digestive products

2. Familiarize the students with the female reproductive tract and how each part contributes to the development of the egg. Refer to TM 4.2 for a diagram of the parts of the female reproductive tract.

   What are the parts of the female reproductive tract and their functions for developing an egg?

   a) Female reproductive tract made up of the ovary and the oviduct
   b) Ovary
      1) Produces the ova, or "yolk", female reproductive cell
      2) Only left ovary is functional
      3) Located in the body cavity near the backbone
   c) Oviduct
      1) Long tube made up of sections where remaining membranes are added to form egg
      2) Consists of the infundibulum, magnum, isthmus, uterus, and vagina
         (a) Infundibulum - Funnel-shaped upper portion that receives the mature yolk from the ovary; site where yolk becomes fertilized

(b) Magnum - Albumen secreted to form various layers of egg white
(c) Isthmus - Adds shell membranes that represent the final shape of the egg
(d) Uterus - Adds a thin, white shell where water is added to develop the albumin
(e) Vagina - Passageway to the cloaca
(f) Cloaca - Held briefly while it rotates into position
(g) Vent - Egg passes from the body

3. Familiarize students with the parts of the egg. Refer to TM 4.3 for a diagram of egg parts.

What are the parts of an egg?

a) Shell consists of three layers.
   1) Inner mammillary layer consists of sponge-like, calcium crystals.
   2) Outer shell layer is made up of hard calcium crystals.
   3) Cuticle is a protective layer that prevents microorganisms from entering egg.
b) Membranes made of protein fibers that exist inside the shell.
   1) Inner membrane holds contents of egg tightly together.
   2) Outer membrane is connected to the shell.
   3) Act as a barrier to outside contaminants.
   4) Reduce evaporation of egg contents.
   5) Air cell forms at large end of shell where two membranes separate.
c) Albumen (egg white) consists of four layers.
   1) Chalaziferous layer surrounds the yolk and extends into the chalazae.
   2) Chalazae are two twisted cords extending from opposite ends of the yolk and help to keep yolk in place.
   3) Liquid inner thin layer, firm dense white layer, and outer thin layer surround the chalaziferous layer.
d) Yolk (ovum) contains the germ spot (female reproductive cell)
   1) Made up of layers that are a record of daily growth.
   2) Orange-yellow colored layer comes from carotene, which is found in feed.
   3) Lighter colored layers reflect growth while hen is not eating during the night.
   4) Darker colored layers indicate daylight hours when hen is eating and has high levels of carotene.
   5) Yolk is surrounded by membrane that helps to maintain spherical shape.

4. Familiarize students with the development of the chick from fertilization to hatching. Refer to TM 4.4 for a diagram of an embryo at approximately 10 days.

How does an embryo develop into a fertile egg?

a) Embryonic development in the chick occurs in 21 days.
b) Cell division process starts as the egg passes through the warm oviduct of the hen.
c) Blastoderm divides into two cells three hours after fertilization.
d) Blastoderm divides further into two layers, the ectoderm and the entoderm.
   1) Ectoderm forms skin, feathers, beak, claws, nervous system, lens and retina, lining of the mouth, and lining of the vent.
   2) Entoderm forms lining of digestive tract, respiratory tract, and other secondary organs.
e) Mesoderm forms an additional layer and develops into bones, muscles, blood, respiratory organs, and excretory organs.
f) Embryo supports itself with membranes that help to utilize food material.
   1) Allantois serves as circulatory system.
      (a) Absorbs oxygen.
      (b) Oxygenates the blood.
      (c) Removes carbon dioxide.
      (d) Removes wastes from kidneys.
      (e) Aids in digestion of albumen.
      (f) Absorbs calcium from eggshell.

2) Amnion filled with fluid and protects embryo during development.
3) Yolk sac surrounds yolk and provides nourishment for the embryo to grow.
   (a) Drawn into body cavity just before hatching.
   (b) Serves as temporary nutrition for newly hatched chick.
4) Chorion fuses with inner shell membrane and forms a protective layer around allantois while it completes metabolic functions.

5. Review the reproductive processes of other livestock that the students may have studied and compare to the poultry reproductive process. Refer to *Introduction to Animal Reproduction* Student Reference for more information.

How does the reproductive process in poultry differ from other livestock?

a) Primary difference is that poultry reproductive process occurs more rapidly.
   1) Length of time from fertilization to birth for cattle is 281 days, swine is 114 days.
   2) Average incubation period for chickens is 21 days and 28 days for turkeys.
b) Majority of embryonic growth and development occurs outside mother's body.
   1) Hen prepares egg but is expelled from body in about 24 hours.
   2) Reproductive process in other livestock occurs inside the mother.
c) Parts of reproductive system differ
   1) Testes of poultry located within body cavity along backbone.
   2) Testes of other livestock located in scrotum which hangs from the body.
   3) Only one of two ovaries functional in poultry.
   4) Both right and left ovary function in other mammals.

F. ***Conclusion***

Reproduction of poultry is different than that of other livestock in many ways. Male and female reproductive parts are located differently than other livestock. The development of the embryo takes place outside of the mother's body while other livestock occurs within the mother's body. The length of time from fertilization to birth is much shorter in poultry than in other livestock.

G. ***Other Activities***

Obtain pictures or video that will show the embryo at different stages of development. Observe the different membrane layers and how they change and adjust as the embryo grows.

H. ***Answers to Activity Sheet***

1. Ovary - Produces the ovum or yolk.
2. Oviduct - Remaining membranes are added to form the rest of the egg.
3. Indundibulum - Receives the mature yolk from the ovary.
4. Magnum - Albumen is secreted and forms various layers of egg white.
5. Isthmus - Adds inner and outer shell membrane that represents the final shape of the egg.
6. Uterus - Adds a thin, white shell.
7. Vagina - Serves as a passageway.
8. Cloaca - Egg is held briefly as it rotates so the large end is expelled first.
9. Vent - Egg passes from body.

I. ***Answers to Evaluation***

1. d
2. c
3. c
4. f
5. g
6. a
7. d

8. b
9. e
10. Shell, membrane, albumen, yolk
11. Ectoderm, entoderm, mesoderm
12. c
13. b
14. d
15. Occurs more rapidly, growth and development takes place outside mothers's body, testes are located within the body cavity along the backbone, only one of the two ovaries is functional.

UNIT - INTRODUCTION TO POULTRY PRODUCTION Name_____

Lesson 4: Reproduction Date_____

EVALUATION

Circle the letter that corresponds to the best answer.

1. What part of the male reproductive system is located along the backbone within the abdominal cavity?

   a. Vent
   b. Papillae
   c. Vas deferens
   d. Testicles

2. What part of the male reproductive system transfers semen to the cloaca?

   a. Vent
   b. Papillae
   c. Vas deferens
   d. Testicles

Match the terms for the female reproductive system of the chicken in the left column with the statement in the right column.

3. _____ Funnel-shaped portion that receives the mature yolk.
4. _____ A thin, white shell is added.
5. _____ Egg rotates so large end is expelled first.
6. _____ Produces the ovum.
7. _____ Albumen is secreted and layers of egg white formed.
8. _____ Long tube made up of sections where membranes are added to form egg.
9. _____ Inner and outer shell membranes added.

a. Ovary
b. Oviduct
c. Infundibulum
d. Magnum
e. Isthmus
f. Uterus
g. Cloaca

Complete the following short answer questions.

10. What are the four primary parts of a newly formed egg?

    a.

    b.

    c.

    d.

11. During embryo development, what are the three layers that develop when the cells divide after fertilization?

    a.

    b.

    c.

Circle the letter that corresponds to the best answer.

12. During embryo development, what serves as the circulatory system?

    a. Chorion
    b. Amnion
    c. Allontois
    d. Yolk sac

13. What serves to protect the embryo during development?

    a. Chorion
    b. Amnion
    c. Allontois
    d. Yolk sac

14. What provides nourishment to the embryo to grow?

    a. Chorion
    b. Amnion
    c. Allontois
    d. Yolk sac

Complete the following short answer question.

15. List four differences in the reproductive systems of poultry from other livestock.

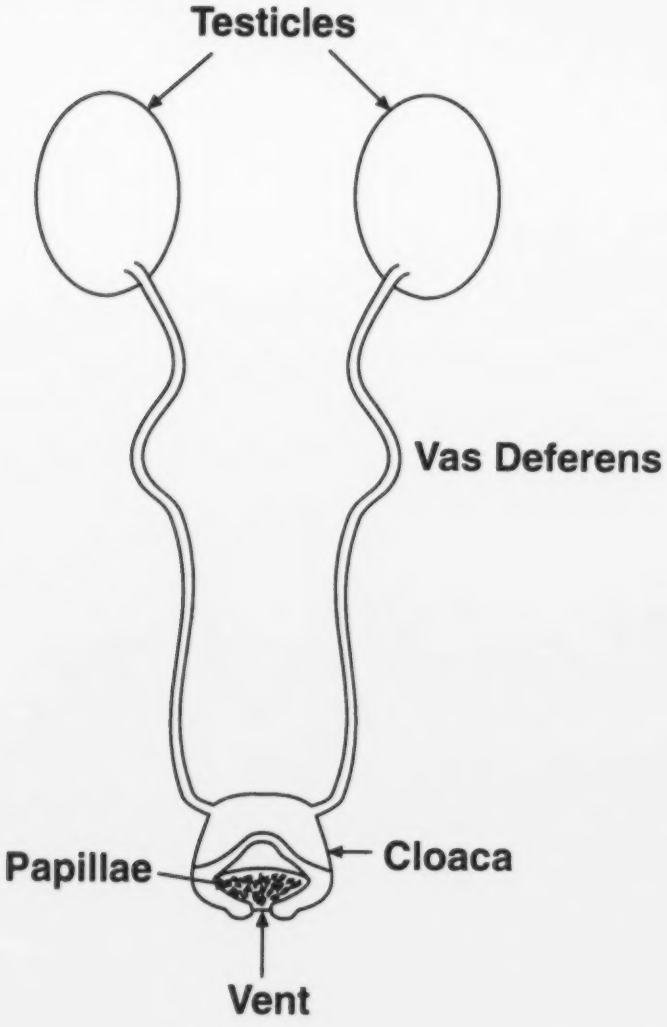
    a.

    b.

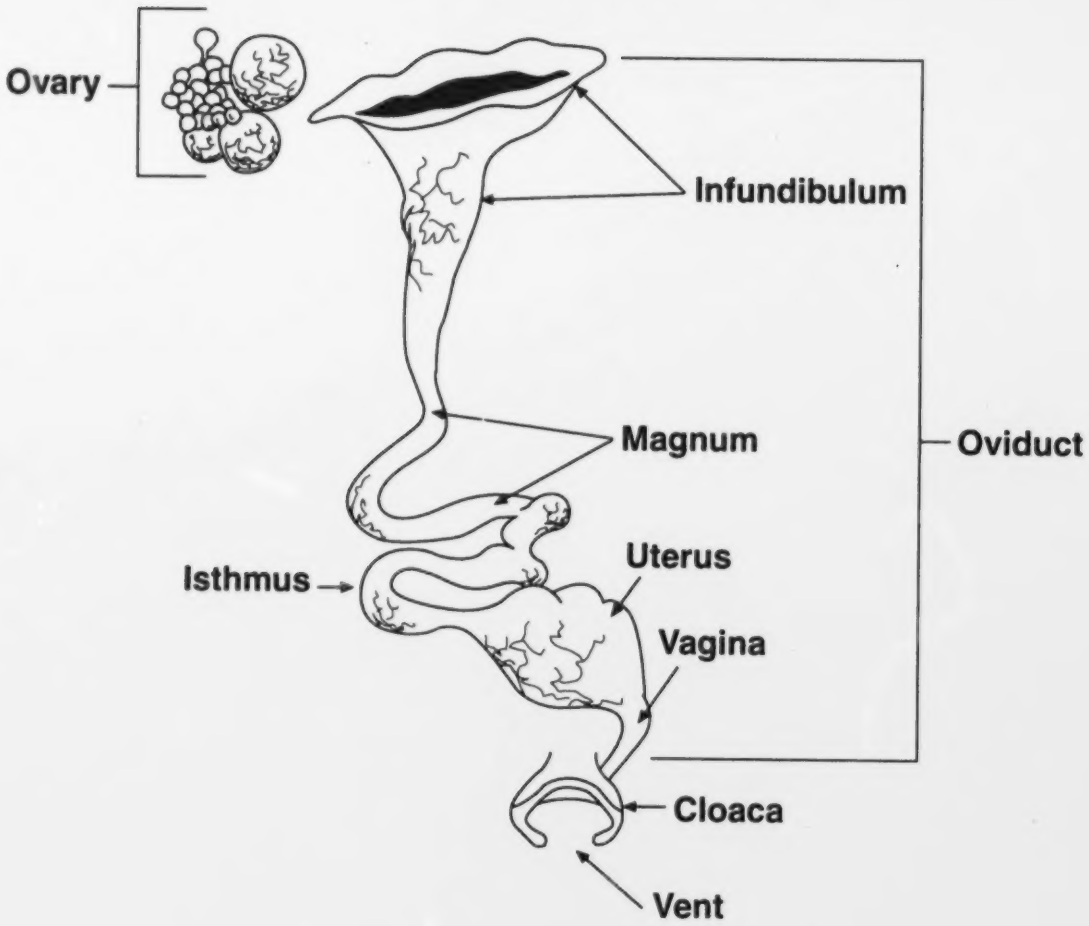
    c.

    d.

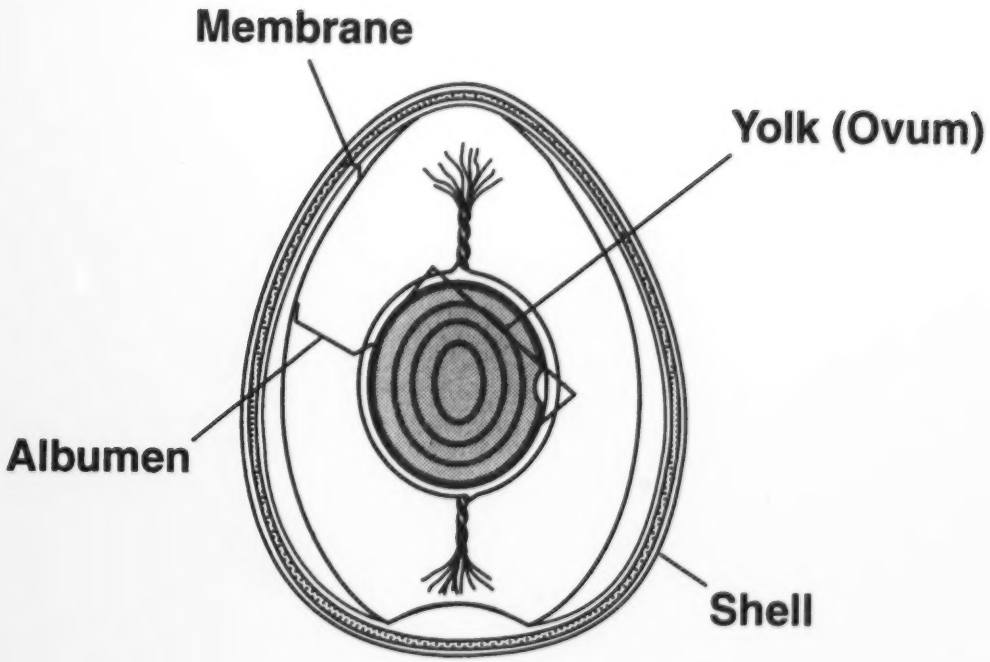
Parts of a Male Reproductive Tract



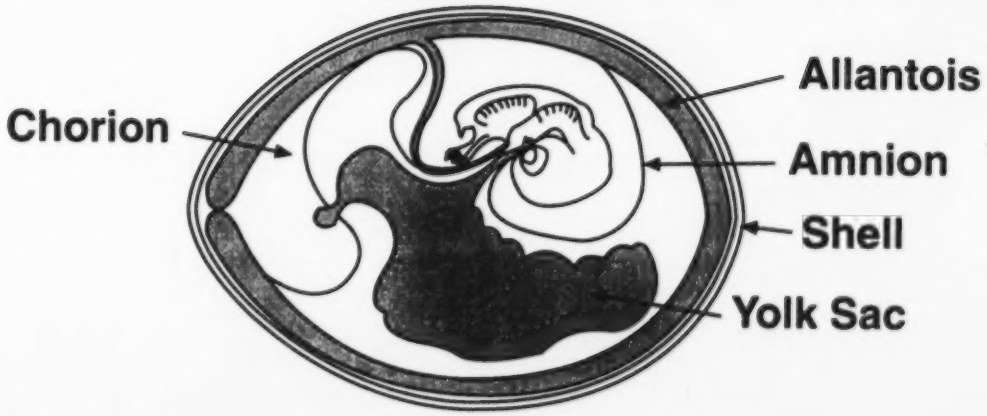
Parts of Female Reproductive Tract



Egg Parts



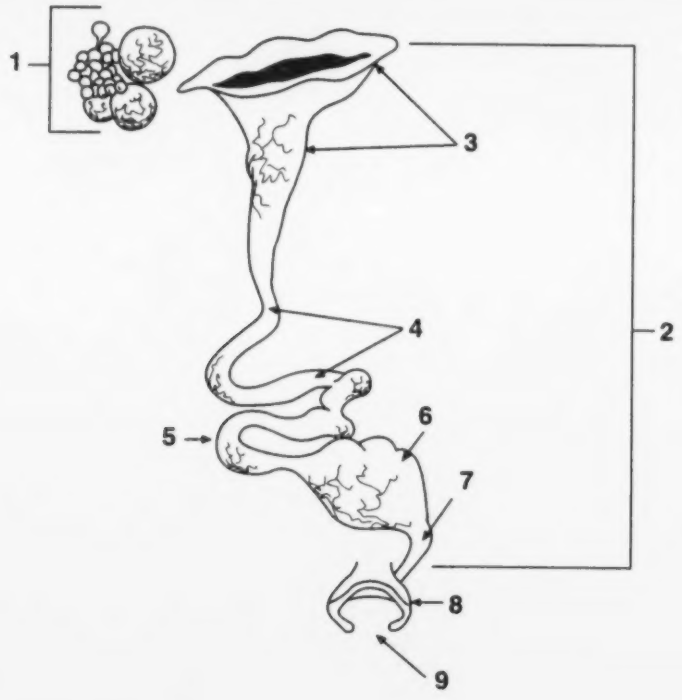
Embryo



Lesson 4: Reproduction Name_____

Female Reproductive System and Egg Development

Objective: Students will label the correct term for each part of the female reproductive system and explain what occurs at this point in the egg development process.



1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

7. _____

_____

8. _____

_____

9. _____

_____

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 5: Health Issues

Competency/Objective: Identify poultry flock health issues.

Study Questions

1. **What are the requirements for maintaining a healthy poultry flock?**
2. **How are common viral diseases prevented and controlled in poultry?**
3. **How are common bacterial diseases prevented and controlled in poultry?**
4. **How are common internal and external parasites prevented and controlled in poultry?**
5. **What is the importance of biosecurity?**

Reference

1. *Introduction to Poultry Production (Student Reference).* University of Missouri-Columbia: Instructional Materials Laboratory, 1999.
2. Activity Sheets
   a) AS 5.1: Symptoms, Treatment, and Prevention of Disease

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 5: Health Issues

TEACHING PROCEDURES

A. ***Review***

Maintaining poultry flock health is vital to the profitability of a poultry operation. Good management and strict sanitation requirements are the best preventive measures to maintain healthy poultry. The threat of viral and bacterial diseases along with parasite problems needs constant monitoring by the poultry producer. This lesson will review common viral and bacterial diseases and common parasites that affect poultry health.

Motivation

Have tapeworms preserved in a jar for students to see and discuss. Discuss how tapeworms could contaminate a bird and how they can spread to other birds.

B. ***Assignment***

C. ***Supervised Study***

D. ***Discussion***

1. Ask students why it is important to maintain a healthy poultry flock. Discuss where they think diseases come from and how they could manage their flocks to prevent contamination of diseases.

   What are the requirements for maintaining a healthy poultry flock?

   a) Good management requirements
      1) Preventive maintenance will reduce stress and prevent disease.
      2) Check daily for signs of disease.
      3) Observe changes in feed and water consumption.
   b) Strict sanitation guidelines
      1) Thoroughly clean housing and equipment between new flocks.
      2) Isolate flocks used for different production purposes.
      3) Only caretaker of flock should enter housing area.
      4) Free of parasites, lice, mites, and rodents.
      5) Clean, fresh water and food kept easily accessible.
      6) Adequate ventilation to reduce moisture and buildup of noxious gas.
      7) Vaccination program to reduce disease outbreak.
      8) Dispose of dead birds according to EPA and Missouri Department of Natural Resources guidelines.

2. Ask students what types of viruses they get as humans. Discuss what a virus is and how we protect ourselves. Apply this to poultry.

   How are common viral diseases prevented and controlled in poultry?

   a) Viral diseases are microorganisms that live in cells and spread the virus by duplication.
      1) Passed through contaminated equipment, feed, clothing, air, other animals.
      2) Resistance to sanitation products makes them difficult to control and prevent.
      3) Enter an animal's system through body openings (eye, mouth, vent, skin, nose, pores of an egg).
   b) Common viral diseases

1) Marek's disease (also range paralysis or acute leukosis)
   (a) Affects many different birds but common in chickens.
   (b) Concentrated in the feather follicles and shed in the dander.
   (c) Internal lesions cause massive internal tumors and can result in death.
   (d) Symptoms include significant weight loss, diarrhea, paralysis in the legs, wings, and neck.
   (e) Affects birds between ages of 6 to 16 weeks.
   (f) Found worldwide and once transmitted there is no treatment.
   (g) Vaccinate day-old chicks at the hatchery.
2) Newcastle disease
   (a) Affects several species of birds including turkeys and chickens.
   (b) Highly contagious and can infect whole flock in three to four days.
   (c) Symptoms in young birds include respiratory problems and nervous disorders.
   (d) Respiratory symptoms in adult chickens are more evident along with reduction in egg production and shell quality.
   (e) Symptoms in turkeys are usually mild and may be unnoticed unless nervous disorders develop.
   (f) Vaccination successful treatment.
3) Avian influenza
   (a) Affects the respiratory and nervous systems of both turkeys and chickens.
   (b) Symptoms include coughing, wheezing, gasping for air, diarrhea, and nervous problems.
   (c) Laying hens may produce fewer or misshapen eggs.
   (d) Death rate is low.
   (e) No vaccine but antibiotics helpful.
4) Fowl pox
   (a) Affects chickens, turkeys, and other birds.
   (b) Infection spread by mosquitos and direct and indirect contact among fowl.
   (c) Symptoms include scabbing around the comb, wattles, ear lobes, and eyes.
   (d) Yellow sores found in mouth and respiratory tract.
   (e) Younger birds will grow slowly.
   (f) Laying hens will produce fewer eggs.
   (g) No treatment but can be prevented by vaccination.
5) Infectious bronchitis
   (a) Only chickens are susceptible.
   (b) Spread through the air and contact with clothing, crates, and equipment.
   (c) Symptoms confined to respiratory system.
   (d) Death rates high in chicks less than three weeks old.
   (e) Laying hens have drop in egg production and produce soft-shelled eggs.
   (f) Vaccinate laying hens.
   (g) No effective treatment except ideal environmental conditions.
6) Laryngotracheitis
   (a) Mainly affects older chickens.
   (b) Symptoms include coughing, sneezing, gasping, and weepy eyes.
   (c) Death rate is high.
   (d) Laying hens have reduction in egg production and soft-shelled eggs.
   (e) Vaccination is available.
   (f) No drug treatment effective

3. Explain bacteria and how the infection can be spread. Equate it to humans and how bacteria can be spread easily by contact and through the air. Discuss how this process can occur in poultry.

How are common bacterial diseases prevented and controlled in poultry?

a) Bacterial diseases caused by single-celled, microscopic organisms.
   1) Requires certain environmental temperature, moisture, and nutrition to multiply.
   2) Some bacteria beneficial for proper food digestion.

3) Easily transmitted by air, contaminated feed, clothing, equipment, soil, and other diseased animals.
4) Vaccines eliminate hazardous bacteria from multiplying.
5) Sanitary environment must be maintained.

b) Common bacterial diseases
1) Pullorum disease
(a) Affects both chickens and turkeys. Other fowl can be infected.
(b) Hen passes bacteria to chicks via the egg.
(c) Spread by contaminated chicks from one to another.
(d) Outbreaks occur in chicks less than three weeks old.
(e) Ruffled feathers, labored breathing, huddling together for warmth, white diarrhea.
(f) High losses in production due to death of chicks and contamination by survivors to unaffected birds.
(g) Perform blood tests and cull birds with bacteria.
(h) Treat with antibiotics and maintain sanitary facilities.
2) Colibacillosis (coliform infections)
(a) Caused by strains of *Escherichia coli* organism.
(b) E. coli bacteria common in intestinal tracts and common in the birds' environment.
(c) Infections range in severity from mild to severe.
(d) Result in respiratory disease, blood disease, intestinal infection, or combination of any or all conditions.
(e) Symptoms include fever, ruffled feathers, diarrhea, labored breathing.
(f) Death may occur suddenly in severe cases and spread through flock quickly.
(g) Isolate infected birds quickly.
(h) Sanitation and management practices reduce organisms.
3) Fowl cholera
(a) Most hazardous infectious disease of turkeys but also infects chickens and other birds.
(b) Enters tissues of the mouth and upper respiratory tract.
(c) Other animals can be carriers of the disease.
(d) Symptoms include loss of appetite, rapid weight loss, lameness, swollen wattles, difficult breathing, yellowish or green diarrhea, and purple-colored comb.
(e) Medicine exists but is not always successful; recovered birds are carriers.
(f) Rigid sanitation program must be followed.
4) Infectious coryza
(a) Respiratory disease that affects many older chickens.
(b) Outbreaks usually occur from introduction of infected or carrier birds into a flock.
(c) Symptoms include swollen face around eyes and wattles, nasal discharge, and sneezing.
(d) Results in decreased feed and water consumption and reduced egg production.
(e) Antibiotics are helpful but culling is best way to combat disease.
(f) Cleaning and disinfecting will eliminate the disease.

4. Discuss the difference between internal and external parasites. Locate samples of parasites for the students to examine and identify their traits.

How are common internal and external parasites prevented and controlled in poultry?

a) Parasites are organisms that live in or on other animals (hosts) and consume nutrients from the host needed to maintain health.
1) May eventually cause death of host.
2) Can survive in hot/ humid conditions or cold and dry conditions.
3) Transmitted through contaminated feed, equipment, clothing, other animals.

b) External parasites
   1) Can cause weight loss and reduce egg production.
   2) High mortality can occur in young poults in severe cases.
   3) Most serious categories of external parasites are lice and mites.
      (a) Lice
         (1) Flat, wing-less, fast-moving insect that bite or suck their prey.
         (2) Symptoms are frequent picking, pale head and legs, and loss of weight.
      (b) Mites
         (1) Blood-sucking insects that transmit diseases and cause scabbing.
         (2) Symptoms include reduced egg production, slow growth, damaged feathers, and possible death.
   4) Periodic inspections of birds will help prevent mites and lice.
   5) Effective treatment administered via dusts and sprays.
   6) Check with Extension Service for current recommendations for insecticides.

c) Internal parasites
   1) Worms are most common and primarily affect birds raised on the range.
   2) Varieties are tapeworm, large roundworm, and gapeworm.
   3) Live in the intestines and linings.
   4) Cause slow growth and lower production.
   5) Specific treatments for each type of worm.
   6) Check flock periodically for presence of worms.
   7) Rotate flocks on the range and maintain strict sanitary environment.

5. Explain what biosecurity is and why it is so important to maintain the health of the flock. Discuss ways that the poultry facility can reduce flock contamination from outside sources.

What is the importance of biosecurity?

a) Biosecurity involves practices designed to prevent the introduction of diseases or parasites into the poultry operation.
b) Reduce risk of outside sources of biological organisms such as viruses, bacteria, and parasites from contaminating the flock.
c) Major components are isolation, traffic control, and sanitation.
   1) Isolation separates the birds by age group.
      (a) All-in, all-out system brings birds in at same time and age.
      (b) Birds marketed at same time with thorough cleaning, sanitization before next flock brought in.
      (c) Keeps out unwanted animals that carry disease.
   2) Traffic control includes both traffic onto and within the farm.
      (a) Only authorized personnel should be allowed in or around facilities.
      (b) Vehicle traffic kept to minimum with necessary traffic cleaned and sanitized as needed.
   3) Sanitation disinfects materials and equipment and ensures cleanliness of personnel.

E. ***Other Activities***

1. Have students research and create a disease and parasite identification chart.

2. Obtain information on vaccination treatments for viruses and bacterial infestations. Familiarize the students with the information contained on the container labels.

F. ***Conclusion***

Poultry health is extremely dependent on the maintenance of ideal environmental conditions. Sanitation and disinfection practices are of utmost importance in the reduction and prevention of disease and parasite contamination. Effective biosecurity measures must be observed by everyone involved in the production process.

G. ***Answers to Activity Sheet***

AS 5.1

1. Internal lesions, significant weight loss, diarrhea, paralysis in legs, wings, neck
2. No treatment
3. Vaccinate day-old chicks at the hatchery
4. Newcastle disease
5. Viral
6. No treatment
7. Vaccination
8. Viral
9. Coughing, wheezing, gasping for air, diarrhea, nervous problems
10. Good management
11. Fowl pox
12. Viral
13. Viral
14. Respiratory system including difficulty breathing, gasping, sneezing, and watery nasal discharge
15. No treatment
16. Ideal environmental conditions.
17. Pullorum disease
18. Ruffled feathers, labored breathing, chilled appearance, white diarrhea
19. Antibiotics and sanitary facilities
20. Bacterial
21. Fever, ruffled feathers, diarrhea, labored breathing
22. Good sanitation and management practices
23. Fowl cholera
24. Bacterial
25. Sanitation program
26. Bacterial
27. Swollen face around eyes and wattles, nasal discharge, sneezing
28. Good management and sanitation
29. Viral
30. Coughing, sneezing, gasping, weepy eyes

H. ***Answers to Evaluation***

1. Daily
2. Isolated
3. Visitors
4. Viral
5. Bacterial
6. b
7. b
8. a
9. b
10. a
11. Answers will vary but may include: good management, sanitation, cleaning, disinfecting, vaccination
12. Internal - lice or mites; External - tapeworm, large roundworm, gapeworm
13. Isolation, traffic control, sanitation

UNIT - INTRODUCTION TO POULTRY PRODUCTION Name_____

Lesson 5: Health Issues Date_____

EVALUATION

Complete the following statements by filling in the blank.

1. The poultry flock should be checked _____ for any signs of disease.
2. Flocks used for different production purposes should be _____ from each other.
3. To avoid bringing in contamination, _____ should be kept to a minimum inside production facilities.
4. Microorganisms that need to live in a host to duplicate themselves can cause _____ diseases.
5. Single-celled, microscopic organisms that require certain temperatures and moisture to survive can cause a _____ disease.

Indicate whether the following diseases are considered viral diseases or bacterial diseases.

6. _____ Fowl pox
7. _____ Pullorum disease
8. _____ Newcastle disease
9. _____ Colibacillosis
10. _____ Marek's disease

a. Viral disease

b. Bacterial disease

Complete the following short answer questions.

11. Give two examples of ways to prevent and control disease in poultry.

    a.

    b.

12. What are two types of parasites? Give an example of each.

    a.

    b.

13. What are the three major components of biosecurity?

    a.

    b.

    c.

Lesson 5: Health Issues Name_____

Symptoms, Treatment, and Prevention of Disease

Objective: Student will become familiar with the symptoms, treatment and prevention of poultry diseases.

Complete chart with correct information.

Disease	Type	Symptoms	Treatment	Prevention
Marek's disease	Viral	1.	2.	3.
4.	5.	Respiratory problems i.e., Difficulty breathing, sneezing, gasping Nervous disorders i.e., Paralysis and tremors	6.	7.
Avian influenza	8.	9.	No vaccine. Antibiotics may help reduce infection	10.
11.	12.	Scabbing around comb, wattles, ear lobes, eyes. Yellow sores in mouth and respiratory tract.	No cure	Vaccine
Infectious bronchitis	13.	14.	15.	16.
17.	Bacterial	18.	19.	Blood tests of breeder flocks. Cull birds that carry bacteria.

Colibacillosis	20.	21.	Infected birds are culled.	22.
23.	24.	Loss of appetite, rapid weight loss, lameness, swollen wattles, difficult breathing, yellowish/green diarrhea, purple-colored comb	Use medicine to lessen disease.	25.
Infectious coryza	26.	27.	Antibiotics and cull all carriers.	28.
Larynogotracheitis	29.	30.	No treatment	Vaccination

UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 6: Processing and Marketing

Competency/Objective: Identify procedures involved in processing poultry products.

Study Questions

1. **What are the steps in processing poultry for meat?**
2. **How has the poultry industry added value to its products?**
3. **What are the common sanitation and inspection concerns?**
4. **What are the steps in egg processing?**
5. **How are eggs marketed?**

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UNIT - INTRODUCTION TO POULTRY PRODUCTION

Lesson 6: Processing and Marketing

TEACHING PROCEDURES

A. ***Review***

The previous lessons discussed management practices necessary to raise healthy and productive poultry. This lesson will review processing and marketing of poultry products. The importance of following sanitation guidelines for processing poultry meat and egg products will also be discussed.

B. ***Motivation***

Have students call or visit a grocery store and talk with the manager or employees in the meat department. They should discuss where the meat comes from, if it is local, from in state, or from out-of-state. Discuss what form it comes into the store and how it is handled and displayed for sale after arrival.

C. ***Assignment***

D. ***Supervised Study***

E. ***Discussion***

1. Considering the motivation technique mentioned above, ask students what is important to the consumer. What do students think is done in the processing plant to prepare a bird?

What are the steps in processing poultry for meat?

a) Remove food (but not water) from the poultry house in preparation for processing.
   1) 8 to 10 hours before taking birds to processing plant.
   2) Minimizes amount of food in the intestine to avoid contamination during evisceration.

b) Major steps in processing
   1) Stunning by electrical shock to render bird unconscious.
   2) Bleeding to allow blood to drain completely to avoid discoloration.
   3) Scalding submerges carcass into hot water (1.5 - 2 minutes). Relaxes muscles that hold feathers making it easier to remove feathers.
   4) Picking removes feathers from the bird by machine that has rotating rubber fingers.
      (a) Remaining feathers burned off.
      (b) Rinse with water to remove foreign matter, blood, feathers from the carcass.
   5) Evisceration removes organs of abdominal cavity, lungs, heart. Feet, head, oil gland also removed at this time.
   6) Rapidly chilled in ice water, graded, packaged, and labeled.

c) Mark as ice-packed, dry chill-packed, or vacuum-packed frozen.
   1) Ice packing places processed poultry into waxed boxes filled with crushed ice or CO_2 (dry-ice).
   2) Dry, chill-packed poultry is placed on small trays with absorbent paper, wrapped in plastic wrap, then passed through a blast freezer to chill meat.
   3) Vacuum-packed frozen poultry wrapped in plastic bags, then frozen in blast freezer.

2. Ask the students what poultry products they eat or have seen available at their local grocery stores and fast-food restaurants. Discuss how these processed poultry items have added to consumer demand for poultry products.

How has the poultry industry added value to its products?

a) USDA grading system and further processing of product has added value to poultry.
b) Grading system enables sale of top grade meat at a higher price than nongraded meat.
c) Further processing of meat and eggs offers convenience to the consumer and increases sales.
d) Industry sells traditional whole, oven-ready carcass and now offers a variety of poultry items that are easy to prepare.
e) Small percentage of broilers are sold as whole carcasses. Most are sold as cut-up parts, cooked, or further processed.

3. Ask students what they think an inspector should look for in a processing plant. Ask students if they see the value of doing scientific testing for bacteria in processing plants. Why or why not?

What are common sanitation and inspection concerns?

a) The poultry industry is responsible for maintaining strict sanitation regulations as set by the government.
b) Only producers who subscribe to the USDA grading system and pass strict regulations for facility and carcass sanitation and quality standards may use symbol of the USDA.
c) USDA inspectors make inspections of live birds to look for symptoms of disease or problems that would make product unsuitable for human consumption.
d) USDA inspects bird carcasses to look for unusual body conditions that make the carcass unfit to be consumed by humans.
e) Carcasses graded by USDA-trained graders.
f) USDA inspectors monitor facilities, employees, plant grounds, and equipment to meet strict sanitation standards.
g) In 1996, HACCP legislation implemented scientific testing for bacteria. (Hazard Analysis and Critical Control Points)
    1) Every plant must adopt a HACCP plan to deal with specific and potential hazards of the product; kept in check by USDA inspectors from the Food Safety and Inspection Service.
    2) Every slaughter facility must have regular carcass testing for E. coli bacteria.
    3) All plants that produce ground-up products must have routine Salmonella testing.
    4) Every plant must write out and perform a sanitation Standard Operation Procedure (SOP) for meeting sanitation responsibilities.

4. Ask students what processing procedures they think are involved in egg production. As a consumer how would they choose eggs in the grocery store.

What are the steps in egg processing?

a) Naturally prepackaged food.
b) Eggs washed to remove any manure or foreign matter stuck to the shell.
c) Wash eggs in water warmer than the eggs. Avoids shrinking slightly and creating a vacuum that sucks in impurities and bacteria.
d) Air-dry eggs after being washed.
e) Oil eggs with paraffin-based mineral oil to replace washed away protective layer.
f) Candle eggs looking for unsuitable eggs.
    1) Air cell size
    2) Yolk shadow position
    3) Presence of blood or meat spots
    4) Presence or lack of germ development
g) Cull unsuitable eggs.
h) Refrigerate eggs.
i) Weighed, graded, and packaged for retail.

5. Discuss ways that the students have been aware of marketing of eggs on television or in print ads. What have they heard about the nutritional value of eggs? What was the source of this information?

How are eggs marketed?

a) Value added to product by wise marketing and use of further processing.
b) Fast food restaurants use egg products for breakfast foods.
c) American Egg Board advertising campaigns promote versatility and nutritional benefits.
d) Quality ensured by egg grading. USDA standards can sell an egg with high grade symbol at a higher price.

F. ***Other Activities***

1. Examine an egg under a bright light, as in candling, to observe any shapes or forms in the egg.

2. Cut up a chicken and identify the parts.

3. Compare processed cold cuts such as smoked turkey slices, turkey ham, and turkey bologna.

G. ***Conclusion***

Poultry and egg production processing is highly regulated to provide a quality product to the consumer. Standards established by the USDA and HAACP guidelines regulate the industry to maintain sanitary and safe conditions for the consumer and the worker. Added value with additional processing has increased demand for poultry products. Marketing campaigns have helped to maintain and improve the image of the poultry industry.

H. ***Answers to Evaluation***

1. Reduces food in the intestine that can cause contamination during evisceration.
2. Stunned, Bled, Scalded, Picked, Eviscerated, Chilled, Graded, Packaged, Labeled.
3. Answers will vary but should include: USDA grading system allowing top grade meat to be sold at a higher price; convenience products add increased sales to the poultry industry. Examples of further processed products may be: breast fillets, nuggets, hot dogs, cold cuts, ground meat, sausages, and frozen dinners.
4. Routine scientific testing for hazardous bacteria
5. To replace the washed away protective layer.
6. Examine the egg in front of light to observe internal characteristics to determine if egg is edible or hatchable.
7. Eggs with USDA grade symbol can be sold at a higher price.

UNIT - INTRODUCTION TO POULTRY PRODUCTION Name_____

Lesson 6: Processing and Marketing Date_____

EVALUATION

Complete the following short answer questions.

1. Why is it important to remove food from chickens before being processed?

2. List the steps in processing poultry meat.

   a.

   b.

   c.

   d.

   e.

   f.

   g.

   h.

   i.

3. The poultry industry has added value to its products by further processing. What does this mean? Give three examples of further processed products of the poultry industry.

4. What important new element has the HACCP legislation added to poultry and meat processing plant inspections?

5. Why are eggs oiled during egg processing?

6. Explain what it means to "candle" the egg.

7. When marketing eggs, why is it important that eggs be marked with the USDA grade symbol?

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Introduction to Poultry Production

Student Reference

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College of Agriculture,
Food and Natural Resources
University of Missouri-Columbia

In cooperation with
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FOREWORD

The development of the *Introduction to Poultry Production* curriculum guide is the result of suggestions by the MVATA Teaching Aids Committee. The Poultry Production Advisory Committee suggested the topics to be included and reviewed the materials.

This curriculum contains six lessons. Topics include overview of the poultry industry, selection and evaluation, production, reproduction, health issues, and processing and marketing.

During the summer of 1981, the Missouri State Board of Education formally adopted the concept of "Instructional Management Systems" (IMS) as a priority for the 1981-82 school year. The Missouri Commissioner of Education described the IMS concept as a practical way of "organizing for excellence" in education. To meet the demand for greater productivity and accountability, the director of Vocational Education applied the elements of IMS to form the Vocational Instructional Management System (VIMS). The VIMS process provides a framework to use in planning and organizing to assure excellence in Missouri's vocational education system by focusing greater attention on the management of teaching and learning. The instructor guide for this student reference incorporates the needed component parts to aid agriculture teachers in the implementation of VIMS.

Persons using this student reference may want to secure a copy of the instructor guide as it contains activity sheets and references that will be useful for a more complete study of this Introduction to Poultry Production Unit.

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INTRODUCTION TO POULTRY PRODUCTION

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Lesson 1: Overview of the Poultry Industry

The poultry industry makes up a large portion of Missouri's agricultural system. It provides millions of people with affordable and nutritious meat and eggs and other useful products such as fertilizers and livestock feed additives. The industry has grown tremendously in the last few decades. It began as small backyard farming systems and has now developed into large commercial enterprises with millions of birds.

What is Poultry?

The term "poultry" refers to any group of birds that are economically important, either for food or fancy. This includes chickens, turkeys, quail, ducks, geese, and guineas. Some people classify birds such as pheasants, partridges and peafowl as poultry. Carefully study the following poultry-related vocabulary.

Pullet - a young female chicken.

Hen - a sexually mature female chicken, usually more than 10 months old, that has started to lay eggs.

Chick -a baby chicken of either gender.

Broiler or fryer - a young male or female chicken, tender-meated with flexible breastbone cartilage, marketed at 6 to 8 weeks of age.

Roaster - a young male or female chicken, tender-meated with breastbone cartilage somewhat less flexible than a broiler or fryer, usually marketed at 7 to 10 weeks of age.

Capon - a surgically unsexed male chicken, usually under 8 months old, used for specialty markets.

Cockerel - a male chicken less than one year old.

Rooster - a sexually mature male chicken.

Poult - a male or female baby turkey.

Economic Importance of Missouri's Poultry Industry

The poultry industry is very strong in Missouri. The statistical information in Table 1.1 from *Missouri Farm Facts 1998* illustrates the effect on Missouri's economy.

Poultry and eggs accounted for 27 percent of the total livestock cash receipts in Missouri in 1997. In comparison, meat animals, which include cattle, hogs, and sheep, accounted for 60 percent of total livestock cash receipts in Missouri during 1997. Total pounds of broiler meat produced was 1,075,000 pounds in 1997 and turkey meat was 589,600 pounds.

Missouri's large scale poultry industry provides many people with careers in production and marketing. In addition, manufacturing companies support enterprises with equipment and facilities. The industry as a whole provides people with excellent dietary sources of vitamins and protein in the form of poultry and poultry products.

Evolution of the Poultry Industry

The poultry industry began with early settlers who raised small flocks of birds around their homes. At first, raising birds for meat and eggs was considered a small enterprise on the farm. Soon demands for poultry and poultry products increased due to the growing population. By the 1800s, farmers began to specialize in poultry production that developed further with the onset of poultry shows by the 1850s. The American Poultry Association was founded in 1873 with the goal of establishing a distinctive set of standards for

Table 1.1 - Effect on Missouri Economy

Product	Rank in U.S.	Total Production	% of U.S. Total	Value of Production
Turkeys	5th	22 million	7.3%	$236 million
Broilers	10th	250 million	3.2%	$403 million
Eggs	14th	1.7 million	2.2%	$85 million
All Chickens (except broilers)	15th	9.5 million	2.3%	$1.6 million

showing birds. This organization published the *American Standard of Perfection* in 1874.

Today the poultry industry in Missouri and in the United States is a highly specialized system of producers and hatcheries with few small home flocks. Many of the hatcheries in Missouri have continued to be productive entities in the state, shipping young poultry worldwide. Much of the poultry industry is concentrated in the southeastern and midwestern part of the United States where the climate is mild and feed sources are nearby.

The four major commercial enterprises in the United States that constitute the modern poultry industry are egg production, broiler production, turkey production, and raising pullets for replacement purposes. Since the late 1960s, there has been a decrease in the number of farms that raise laying hens; however, the size of flocks and farms have grown significantly. The total number of laying hens has decreased but egg production has been steady due to an increase in rate-of-lay per hen. Rate-of-lay refers to the total lifetime production of a hen. Egg consumption per person has decreased due to alternative breakfast foods, such as cereals, and concerns about negative health effects of eggs in relation to cholesterol intake. U.S. per capita production of eggs appears to have stabilized and has been increasing since 1990 with expansion in midwestern states.

Production of broilers and turkeys for meat has skyrocketed since the late 1960s. Just over the past five years, broilers have increased in sales $189 million and turkeys have increased in sales $57 million. There has been an increase in consumption per person due to further processing of poultry meat into products such as chicken nuggets and precooked breast fillets. Also, since poultry meats are considered a low cholesterol food, public interest in a low cholesterol diet has also played a role in the growth of the industry.

As the different industries have grown, so has the demand for pullets, broiler chicks, and poults. Broiler chicks and poult production facilities are typically located close to the specific production facility, with breeder flocks somewhat isolated from the production farms. They consist of large hatcheries that incubate fertilized eggs, hatch, and deliver chicks or poults to the farms. Some hatcheries may provide other services such as vaccinations, egg injections, and beak trimming. Pullets and turkeys are sexed at the hatchery.

Common Breeds and Production Lines

For identification purposes, poultry is divided into breeds, varieties, types, and classes. A breed is a group of birds that share the same characteristics and have a common origin. A variety is a subdivision of a breed that is based on a group of specific traits, such as color or comb shape. Type describes the purpose for which the bird is used; the two general types are egg-type and meat-type. The class associates the bird with its place of origin. There are four general classes of poultry that include Mediterranean, American, English, and Asiatic.

Poultry raised from commercial producers are identified by breeder strains. Strains are families or breeding populations possessing common traits. They may be subdivisions of a breed or variety or may even be systematic crosses. However, a strain shows a relationship more exacting than that for others of similar appearance. Strain crossing refers to crossing of different strains of the same variety. The commercial poultry industry today is based almost 100 percent on the strain approach. Many commercial strains exist. Examples of chicken strains are Cobb, Hubbard, DeKalb, Hyline, Babcock, and Shaver. An example of a turkey strain is Nicholas. Strain breeders are constantly looking for additional material for gene pools.

The *American Standard of Perfection*, published by the American Poultry Association, catalogs more than 300 different breeds and varieties of poultry. Of the many different species listed in the publication, very few are used commercially, but it is an excellent reference for birds raised for fancy or showing purposes.

Most commercial breeds and strains of chickens used for meat and eggs are a product of cross mating, crossbreeding, or inbreeding. Cross mating involves mating birds within the same breed. Crossbreeding is mating birds of different breeds or varieties. In an inbreeding system, birds that are very closely related to each other are mated to get specific traits.

Some chicken breeds are used primarily for commercial egg production. The most common commercial white egg layer hen is the Single

Comb White Leghorn (a Mediterranean breed) for her excellent egg production. Some smaller flock owners choose to raise dual-purpose, brown egg-producing strains because they use them for both egg and meat production.

The most common bird used for meat production was originally a cross between the male Cornish of the English class and the female White Plymouth Rock of the American class. Hens produced by this cross have a low rate of egg production but are very efficient in meat production.

Turkeys are usually bred from a definite line or strain. Turkeys are typically referred to as their strain name rather than by their variety name. Common examples of commercial production strains are the Broad-Breasted Large White, Beltsville Small White, Nicholas, and British United Turkey (BUT).

Types of Poultry Enterprises

Three types of enterprises exist in today's poultry industry: commercial, backyard, and niche markets. A commercial enterprise raises birds in quantities of 100,000 or more. Backyard enterprises raise smaller amounts. The niche market enterprise raises birds in an alternative manner to the commercial industry. It produces products that are restricted to specific guidelines such as utilization of special medications, facilities, or production process.

Commercial Enterprises - The three types of commercial enterprises include egg production, broiler or turkey production, and raising pullets and poults for replacement, which supplies the other two enterprises with replacement birds. The use of vertical integration is very common in the commercial poultry industry. Vertical integration means that one enterprise owns and controls more than one type of production operation. For example, a farmer may choose to purchase a feed mill, therefore supplying his own flocks with ready-to-eat feed. This system dramatically increases the size of operations and efficiency. A vertical integration system is run by poultry processors or manufacturers who are in charge of the majority of management decisions and problem solving. Nearly all meat production systems are produced under vertical integration and about 50 percent of egg production uses such a system. The poultry meat industry is unique because most of the products are sold under a brand name, such as Holly Farms, Tyson, Cargill, or Con-Agra.

Commercial broiler fowl and laying hens are produced by specialized genetic companies that own breeding fowl. These companies incubate and hatch commercial layers and broiler chicks. Such operations usually provide producers with the bird, a vaccination, feeding, lighting, and pullet growing program. They also provide veterinary and technical field services.

Commercial egg production systems are very large. They usually have a minimum of 100,000 head and many farms have up to 1,000,000 birds at a time. Hens are kept in cages with environmentally controlled housing. This controlled housing has specific lighting programs and computers that control the ventilation. Egg collection and feeding is completely automated.

Backyard Enterprises - Many people choose to take advantage of the efficiency of poultry and raise their own smaller flocks. Maintaining a chicken flock requires a minimal amount of space and many people enjoy having the fresh eggs and meat available to them from their own backyard. Breeds recognized for dual purposes such as the Rhode Island Red, Plymouth Rock, New Hampshire, Wyandotte, and Orpington are popular among small flock owners because they are relatively efficient in both egg and meat production.

Niche Market - A niche market system provides meat and eggs grown in an alternative manner. Systems such as these may raise their birds cage-free and organically. The term "organic" has had many different definitions. In general, "organic" refers to products produced free of synthetic chemicals and drugs. Current standards exist but vary from state to state. There are more than three dozen different certification organizations within the United States that try to define organically grown meats and produce. The USDA Ag Marketing Service is currently developing a National Organic Program. University Extension works with farmers who raise products, both livestock and crop production, for the niche market.

Career Opportunities

The poultry industry provides many people with a variety of careers from marketing to research sciences. The poultry industry has grown

significantly over the years and the systems of production have become very specialized. As technology and research continues to develop, so do the employment opportunities in the poultry industry. Many positions within the poultry industry require specialized training and/or certification. Examples of these occupations are chick sexers, artificial insemination technicians, blood testers, and sanitation workers. Other jobs require a college degree for employment. Examples of these jobs include poultry breeding, field service personnel, waste systems managers, personnel officers, and accountants. Jobs such as poultry geneticist, scientist, or veterinarian require an advanced degree.

Summary

In general, poultry is any bird raised for food or show. The poultry industry in the United States has grown from small, family-owned, backyard flocks into large commercial enterprises. These enterprises are very important to the economy of Missouri and the United States. The different types of poultry enterprises include the commercial, backyard, and niche market. There exist many different breeds and strains of poultry, but only specific crosses of birds are used in the poultry industry. The size and diversity of the poultry industry offers employment opportunities to many people with varied experience and skills.

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Lesson 2: Selection and Evaluation

Selecting high quality poultry is a skill that is important to egg and meat production. By evaluating and selecting the most productive birds, overall improvement of the flock is achieved. It is important for commercial operations to develop and produce quality poultry in order to remain profitable and to maintain a positive reputation in the industry.

Poultry Parts

Figure 2.1 (below) and Figure 2.2 (page 6) explain the parts of a chicken and the parts of a turkey. It is important to be familiar with the common terminology of poultry to select and evaluate high quality birds.

Selecting Broiler Breeder Poultry

Broiler breeders are the parent stock used to produce hatching eggs for commercial broiler production. When selecting broiler breeders, look for factors that give evidence to a healthy, productive bird. These factors include general health, body weight, and conformation. Conformation is the type, form, and shape of the broiler and may include feathering, fleshing, fat, and freedom from defects. Performance data is also used to determine the genetic superiority of the breeding flock.

General health refers to indications of disease or other abnormalities that may indicate that the bird is not fit for humans to eat. In general, a bird in good condition has no severe abnormalities such as unusual growths or lumps, bloody diarrhea or yellow to green-tinted feces, bodily discharges, lameness, or fever.

A healthy bird is very vocal. Its rounded, bright eyes are very alert. The comb and wattles are bright red, with a smooth, sturdy, waxy texture. The feathers around the vent (posterior opening, anus) are clean and dry as the rest of the body plumage is close-fitting and clean. An unhealthy bird may exhibit sluggish behavior. The comb may be coarse, discolored, darker or lighter than normal. The feathers around the vent may be dirty and damp, and the body feathers may be disarranged. Carefully observe Figure 2.3, which shows the head of a healthy chicken compared with an unhealthy chicken.

Body weight of offspring is closely related to the weight of the broiler's parents at seven weeks. Evaluate birds at seven weeks and select only the larger birds.

Figure 2.1 - Parts of the Chicken

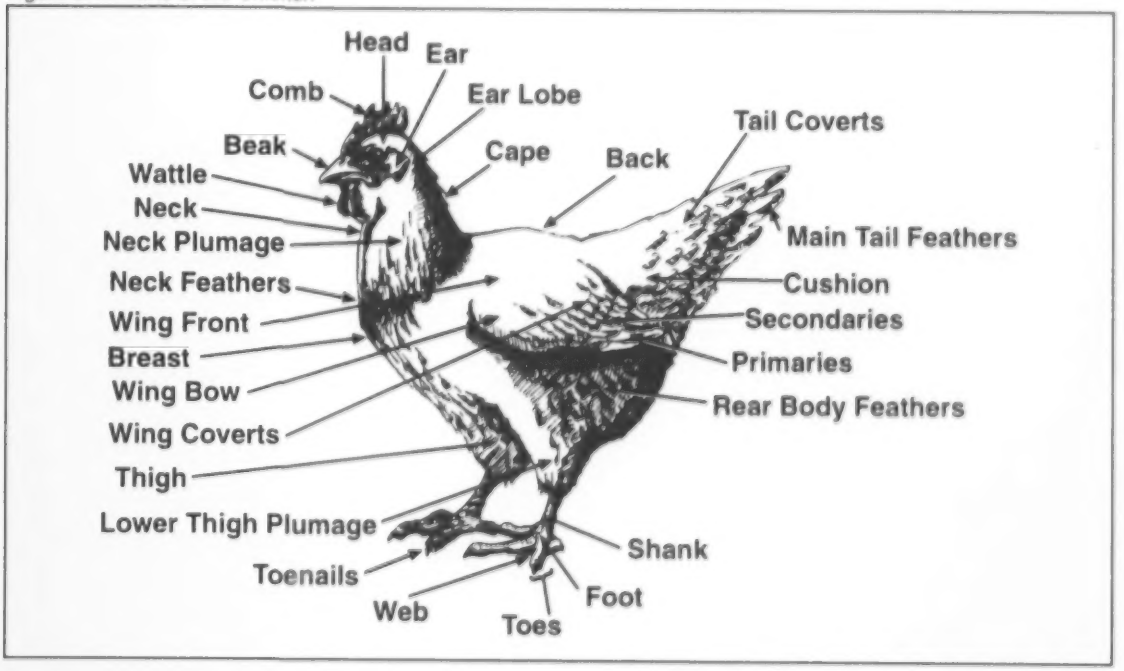


Figure 2.2 - Parts of the Turkey

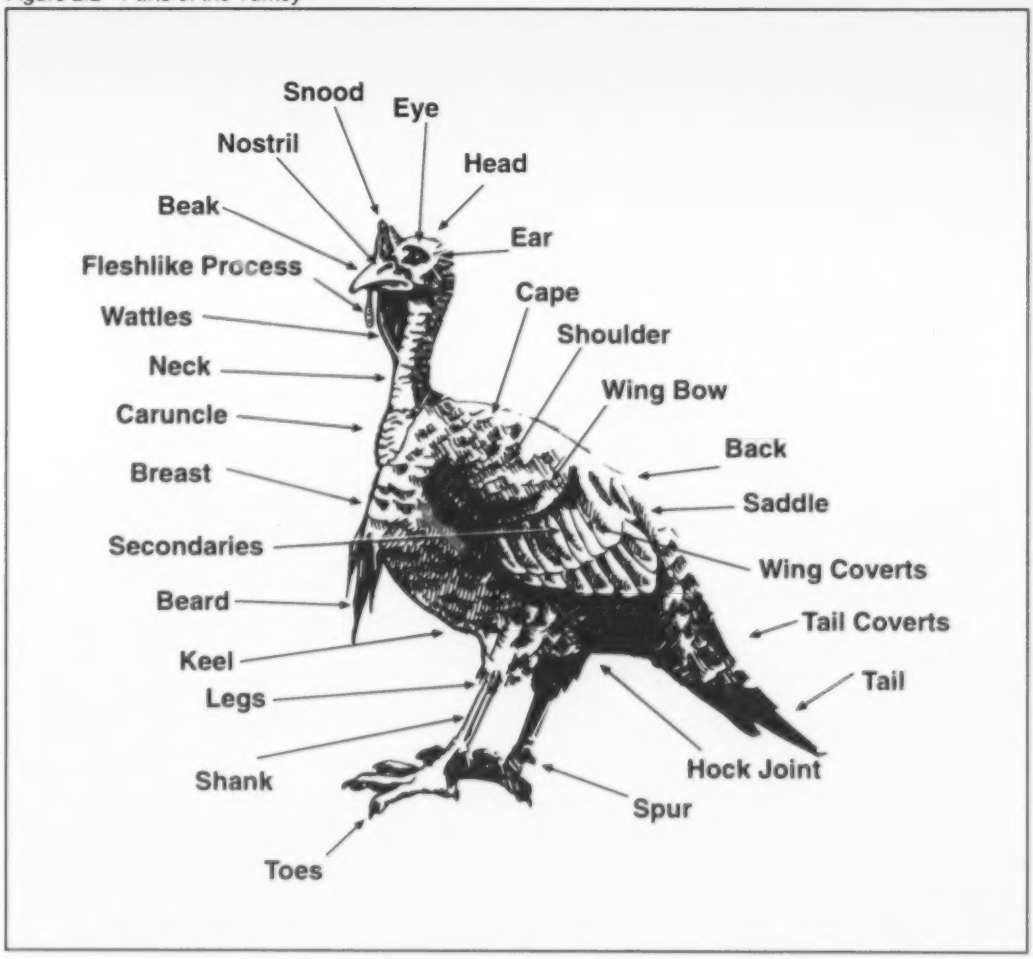
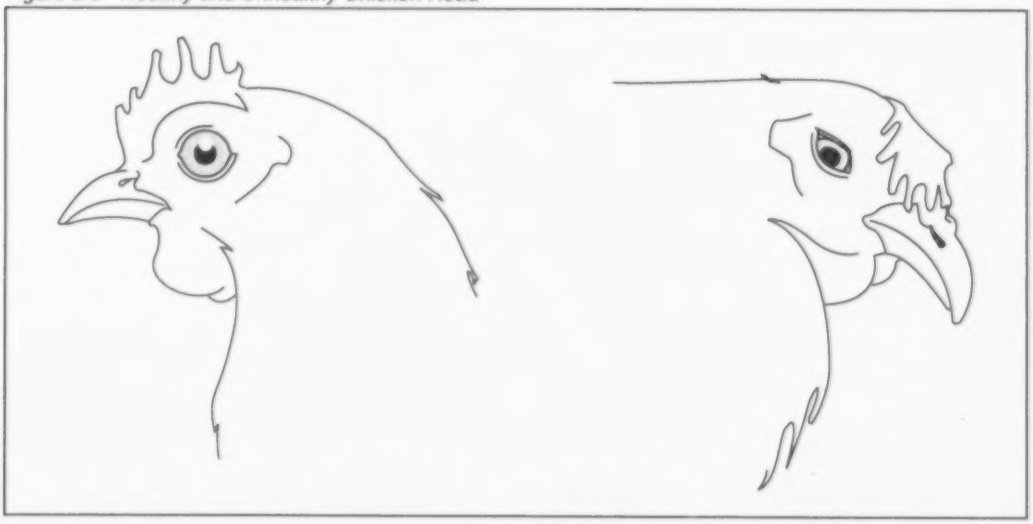


Figure 2.3 - Healthy and Unhealthy Chicken Head



Conformation refers to the general shape of the bird. The preferred shape of a broiler includes a crescent-shaped back, broad breast, and upright head. A bird with poor conformation has a wedge-shaped body, hunched back, crooked breasts, backs, and legs. Broilers' feathers should lay well, be close fitting, smooth, and unbroken. A chicken with poor feathering may have twisted feathers, broken quills, or bare spots on the skin, which may result in sunburns. The most important factor when evaluating feathering is the presence of pinfeathers. These are the feathers just coming through, or still under the skin. The less pinfeathers, the better the quality of the bird; pinfeathers are difficult to remove during processing.

Fleshing refers to the commercially important muscles that make up the shape of the bird. Quality meat poultry will have thick, rounded breasts that are wide through to the keel. The back will be toned all the way down the length of the birds' vertebrae. The legs are thick and meaty. A bird with poor fleshing may have a breast that comes to a point, or inverted instead of protruding. Also, the legs and back may be thin.

The most common problem associated with fat coverage in broilers is a lack of the healthy layer of subcutaneous fat. Evidence of little fat can be seen by either thin skin over the abdominal area, the area where the skin over the thigh is connected to the breast, and under areas with heavy feathers. Fat can be easily measured by gently pinching the skin of the abdomen. Hardness indicates fat; softness means there is little fat.

Defects in broilers are damages caused to the bird that result in downgrading of the meat. When selecting birds, avoid those with defects such as insect bites, bruises, calluses or watery blisters on the breast. Discoloration and bare areas, a result of the bird picking, are also considered defects.

Such defects of birds are often a result of improper handling or raising of the bird. For this reason, it is important to handle birds properly while examining it for selection. Carefully study the section on handling techniques to avoid causing defects while selecting the birds.

General disqualifiers include black feathers found in cockerels, green or black pigment found on the shanks, crooked toes (greater than a 90 degree bend), swollen hock joints, and infected foot pads.

Performance data for selection of broiler breeders is measured by the growth rate. Rapid growth reduces the time to market and results in savings in feed consumption. A positive growth rate often reflects good breast width, body depth, and fleshing.

Turkey Breeder Selection

The criteria for selection of broiler breeders can also be applied to the selection of turkey breeders with only a few slight differences. Conformation is even more important because turkey carcasses are often marketed whole and at higher weights. Rather than watching for a droopy, coarse - textured wattle and comb, an unhealthy turkey may give evidence of this by sagging caruncles. Caruncles are the fleshy protuberances on the naked portions of the head, face, and neck of the turkey. Turkeys are susceptible to certain diseases and infections. Vaccination records should be checked for all breeding stock.

Selection of Commercial Layers and Pullets

Commercial layers are selected and evaluated by their pigmentation, general health, and conformation.

Layers loose yellow pigmentation from the skin and shanks as they lay eggs. This loss of color is called "bleaching." The pigment bleaches from the pigmented areas in a definite order according to the approximate number of eggs she has laid. When a hen ceases to produce, the pigments return to the body. Bleaching occurs in the following order: vent, eye ring, ear lobe, beak (corner of the mouth toward the tip), bottom of the feet, loss from front, back, and sides of shank, and the hock and top of toes.

A highly productive hen will have good general health. The comb and wattles of a productive bird are bright-red, waxy, smooth, and full. The eyes are bright and round, and the eyelids and eye ring are bleached. The beak should be in the process of bleaching or already bleached. The vent should be fully bleached, supple, and moist. An unproductive laying hen will have small, scaly, discolored wattles and comb. The eyes will be

droopy and sunk in, the beak will be yellow, and the vent will be dry and yellow.

The conformation of a quality hen with a high rate-of-lay will have a broad head, smooth face, large body capacity, soft and flexible abdomen, supple skin, and flat, smooth shanks. The pubic bones should be thin, flexible and spread wide enough to fit two to four fingers between them. A hen with a poor rate-of-lay will have a long, crow-shaped head, thin back, poor body capacity, hard abdomen, leathery skin, and round, scaly shanks. The pubic bones will be close together and not flexible.

Pullets are sexually immature chickens that are less than 22 weeks of age. The pullet should show signs of reaching sexual maturity by good comb and head development. They are evaluated for their potential to be highly productive layers. A healthy pullet shows no sign of disease. The eyes are round and prominent and the head should have smooth skin of a normal color associated with the breed. A strong, wide back, broad body, and roomy heart girth indicate quality body conformation. Pullets should have smooth feathers with no bare spots, and the skin color on the shanks should be of normal color for the breed. Legs should be straight and even with no abnormalities in the feet and toes.

Proper Handling Techniques

Proper handling is crucial in selection and evaluation of poultry. Handling poultry provides the ability to observe areas of the bird that are impossible to see from observing a standing bird. Appropriate handling helps reduce defects and injuries to the bird. Chickens and other commercially important poultry are naturally nervous creatures. It is important to have good control of the bird so it cannot get away and possibly injure itself.

To catch a bird, gently put one hand above the back of the bird and quickly, yet gently, pin the bird down. Refer to Figure 2.4.

Slide the other hand under the breast until it is resting in the palm of the hand. Steady the bird by putting a hand on its back and hold the wings down. Place the index finger between the hocks. Put a thumb around one leg and the rest of the fingers around the other leg. See Figure 2.5.

Figure 2.4 - Catching the Bird

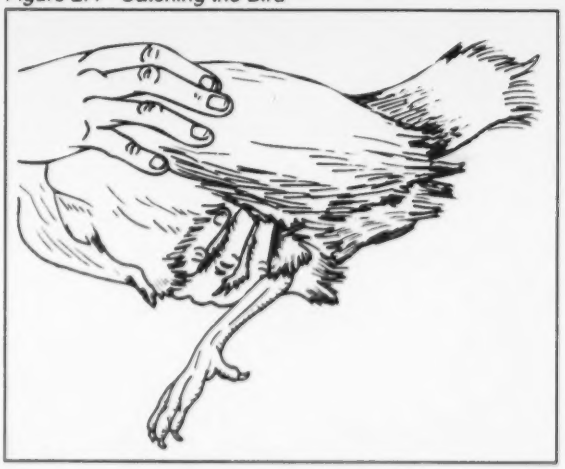


Figure 2.5 - Steady the Bird

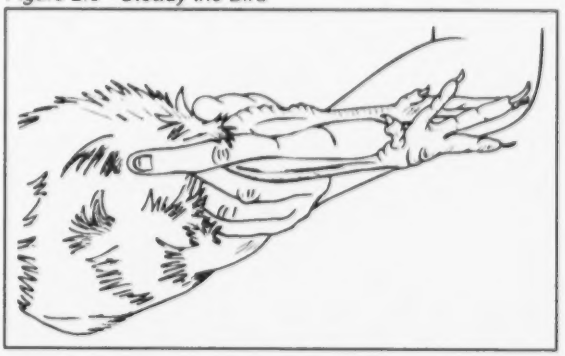
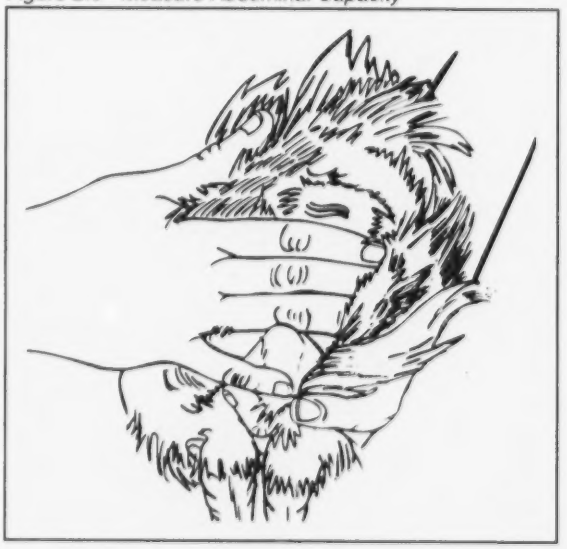


Figure 2.6 - Measure Abdominal Capacity



Gently lift the bird while keeping the other hand on its back. Hold the bird's head down with the back resting against the examiner's stomach. This will allow observation of the vent, abdominal capacity, bleaching of the feet and shanks. The pubic bones and the softness of the abdomen can also be felt. To measure the abdominal capacity, place fingers between the keel bone and the pubic bones. Count how many fingers fit; this is the abdominal depth. To measure the abdominal width, turn the bird towards the examiner with the head under the elbow. Repeat measurement with fingers at a 90-degree angle. See Figure 2.6.

To check for molting in wing feathers, keep the hen tucked under the elbow. With the other hand, gently open the wing and count the feathers. Return the bird to the coop with the breast in the palm of the hand and fingers holding the legs as before. Place the bird in head first and be sure both feet are completely on the floor before releasing it.

Summary

In the poultry industry, birds are selected and evaluated on their general health, conformation, body weight, and performance data. The qualities in a broiler breeder will vary from the layer and pullets but the same criteria is evaluated. Turkey breeder selection is very similar to selection of the broiler breeder. Handling the birds is an important part of the evaluation process. It must be done properly to avoid injuring the birds during the examination.

Credits

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Lesson 3: Production

The production and management of poultry products is one of the most specialized agricultural systems today. Everything from housing to feed is the result of decades of research that has helped make the commercial poultry industry a very efficient, high-yield business. This lesson will discuss the management practices for each production system including the facilities, nutritional requirements, and waste management.

Production and Management Practices

As mentioned in Lesson 1, the four major commercial enterprises are broiler production, turkey production, egg production, and pullet production for replacement purposes. Each system features specific management and production practices that will obtain maximum profitability. The commercial poultry industry has developed into a system referred to as vertical integration. Vertical integration is when two or more stages of the production, processing, and distribution is controlled by a single firm. For example, feed manufacturers and processing plants (referred to as the contractor) provide the financial needs and control management decisions while producers/growers provide the facilities and labor.

Broiler production is well suited to assembly line techniques. As a result, the broiler production has developed into a highly integrated industry with 99 percent of broilers produced under contract. A typical integrated firm will provide the chicks, feed, processing, vaccinations, supervision, and transportation. The producer/grower provides housing, grow-out equipment, (feeders, waterers, and brooder houses), utilities, labor, and management. With improvements in production practices, the time to produce a broiler has decreased thus reducing the feed consumption costs. Broiler units are highly automated for feeding, watering, lighting, and ventilation. Commercial slaughter operations are regulated by state and federal inspections.

Turkey production is following a trend of fewer but larger farms and processing plants. Turkeys have traditionally been raised on the range but confinement rearing with highly automated feeding and watering systems is standard. As with broiler production, turkeys are typically grown under the vertical integration system.

Layers used for egg production are being raised by fewer but larger flocks. Producers strive for maximum egg production at minimum costs. A good standard for high-producing strain will produce an average of 285-310 eggs over a 12-14 month laying cycle. Layers are produced primarily on an integrated or contract arrangement. Environmentally controlled housing is used with regulation of the light and ventilation.

Replacement pullets can be raised by egg producers or they are purchased from pullet growers just prior to placing in the layer house. The trend is moving toward specialization with egg producers only producing eggs while other specialists only raise replacement pullets. Pullets can be raised on floors, in cages, or a combination of starting on the floor and moving to growing cages at 6 to 8 weeks. Sanitation is very important when raising starter pullets to avoid disease and contamination. Ages and strains of birds should not be mixed with other birds in the same house and all sanitation and disposal rules should be strictly followed.

Facilities and Equipment

Proper housing of poultry is important to achieve a healthy and productive flock. Also important is the convenience and ease of the producer to maintain the greatest profit. The major factors to consider in facility planning are the temperature, moisture, ventilation, and lighting.

Small chicks are started in facilities referred to as brooders or brooder houses. All chicks, whether they are broilers are replacement pullets, will start in brooders. Special heating equipment is necessary to keep the chicks warm until well-feathered. Small, trough-type feeding and watering equipment suitable for day-old chicks is used. Fresh air must be provided but with no drafts on the floor. Lighting may be provided by the heating equipment or room lights need to be left on.

Pullets can be raised in the same house used for brooding or they may be moved to separate housing. They may be grown in partial cage systems or complete cage growing systems. The partial cage system starts the pullets out on the floor for the first 6 to 10 weeks and then they are

moved to cages. The complete cage growing system grows the pullet entirely in cages. Lighting must be regulated closely because it will affect the sexual maturity rate of the pullets. Feeders and waterers should be placed throughout the house in convenient locations. Pullets can also be raised on the range but this method is better suited for smaller flocks.

Layers used for egg production may be housed in caged systems or in open- or slat-floor systems. Caged systems are becoming the most common for commercial operations. Cage-laying systems are typically multiple-bird cages usually holding 5 to 10 birds in one cage. Egg production in an open-floor system is not very efficient for commercial egg producers. Open- or slat-floor systems result in dirty or broken eggs, stress to hens competing for food, extra cost for litter, and more labor to collect eggs by hand up to three times a day. Laying houses must provide hens with adequate temperature and ventilation. Fresh, clean food and water may be provided automatically or by hand. Lighting must be closely regulated for optimum egg production with a minimum of 14 hours and a maximum of 17 hours of light per day. Laying houses also need to provide an egg room to hold eggs in a cool and dry environment while being held for market.

Broilers typically are raised in large confinement facilities. Single houses may hold 20,000 to 28,000 birds with .75 or .8 square feet allowed per bird. Partial house brooding is utilized with one end of the house restricted until the chick is three weeks old. This helps to maintain and monitor the heat available to the birds while they are young. After that, the chicks are allowed full range of the house. Automated feed and water is provided. Natural and artificial lighting is used.

Turkey poults are raised in clear-span, metal-roofed buildings. These buildings are built without poles through the interior area to make it easier to move cleaning equipment through the building and provide better ventilation. Brooding, growing, and finishing, or a combination of all steps, take place in the same building. They typically have dirt floors that are covered with an absorbent litter material.

Nutritional Requirements

Poultry are very different from other farm animals in regards to their nutritional needs. Birds use nutrients every hour of the day. Egg production, in particular, places a high demand for nutrient use to produce an egg. The digestion system of poultry is very rapid; respiration and circulation are fast; they grow at a rapid rate; are more sensitive to environmental influences; body temperature is higher than other farm animals; and they mature at an earlier age. These factors place a great strain on their nutritional needs.

In poultry, efficiency of production is directly related to proper feeding. Birds are fed complex rations containing the essential ingredients for maximum meat or egg production, fertility, and body maintenance. The feed system is composed of five nutrient classes: 1) energy (carbohydrates and fats), 2) proteins, 3) vitamins, 4) minerals, and 5) water.

The energy provided by carbohydrates powers the movement of muscles and produces body heat. Extra energy is stored within the body as fat. Sources of energy include animal products such as fats and plant products such as grains (yellow corn, oats, milo) and vegetable oils. Protein provides amino acids which are the building blocks for cell growth (i.e., bone growth, tissue growth, or egg production). Vitamins are made up of fat- or water-soluble organic substances that aid the birds in digestion, absorption, and metabolism of nutrients. They also regulate the formation and development of new cells. Minerals are inorganic elements that help the bird develop bones and eggshells. Water helps to absorb nutrients from the digestive tract and aids in metabolic reactions.

Wastes and By-products

Manure, carcasses, and eggs are just a few examples of the wastes and by-products produced by commercial poultry operations. An operation with 30,000 laying hens can produce 40 tons of manure a month or nearly 500 tons a year. Proper handling, storage, and application of manure from poultry operations can protect water resources and increase profits of bird and crop enterprises. Animal wastes are an important source of plant nutrients for crop production. Manure can also be dried and used as animal feed for other livestock. Dried manure is high in protein, calcium, and phosphorous.

Selection of a waste management system is based on factors such as location, size, type and use of cropland, number of birds, and type of housing.

Typical housing systems include cages above dry or liquid pits, floors with litter, and outdoor ranges.

Cages with layers or pullets are in rows of decks. Manure falls through the pit directly or is scraped from dropping boards below the cages. Deep pit systems can develop into solid manure if kept dry enough. Air blowing across the pits dries the manure under the cages permitting solid manure handling. Manure is scraped or flushed with water from the pits directly to a spreader or to a storage area. If kept dry, manure can accumulate in pits for at least a year and often longer.

Broilers and turkeys are typically raised on concrete or earthen floors. Litter management includes removing caked manure from around waterers, stirring to increase drying, and adding new litter. Periodically, tractor loaders remove the manure-litter mixture and the area is cleaned and disinfected.

Summary

Poultry production systems utilize facilities and nutritional needs that are the result of decades of research that help achieve optimal production results. Commerical poultry operations are generally operated on an integrated or contract arrangement. Facility planning includes controls for temperature, moisture, ventilation, and lighting. Nutritional requirements are extremely important to the health and growth of poultry. Chickens have a high demand for nutrient use. Feed and watering systems are typically automated and are part of the poultry facility system. Poultry wastes and by-products need to be managed properly to avoid pollution of water resources. Manure is also used as fertilizer for crops and processed into feed.

Credits

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Lesson 4: Reproduction

The male and female reproductive systems in poultry are very different from other livestock. The most obvious difference is that the egg is fertilized in the hen, surrounded by a hard shell, and expelled from the body. In other livestock, eggs are fertilized and grow within the female until birth. This lesson will review poultry reproductive systems and how they function.

Male Reproductive Tract

A male bird's reproductive system is completely contained within the body cavity. Refer to Figure 4.1 for a diagram of the male reproductive tract. The testicles are located along the backbone within the abdominal cavity. There are two testicles and they are made up of ducts that produce and secrete sperm. The testicles are connected to the vas deferens, which is a tube that transfers semen to the cloaca. The cloaca is the common area where the reproductive and digestive systems meet. The male cloaca joins the female cloaca in the mating process. Attached to the wall of the cloaca is the papillae. The papillae transport the sperm to the female reproductive tract during mating. The vent is the opening of the cloaca and releases the reproductive and digestive products.

Female Reproductive Tract and Egg Development

The female reproductive tract of poultry species is made up of the ovary and the oviduct. Refer to Figure 4.2 for a diagram of the female reproductive tract. The ovary produces the ovum, or "yolk" which is the female reproductive cell. Poultry have two ovaries, however only the left one is functional. It is located in the body cavity near the backbone. The female chick has several thousand ova (plural of ovum) at the time of hatching. These may develop into full-sized yolk as the hen matures.

At maturity the ova are released from the ovary to enter the oviduct. The oviduct is a long tube made up of different sections where the remaining membranes are added to form the rest of the egg. The oviduct consists of the infundibulum, magnum, isthmus, uterus, and vagina.

Figure 4.1 - Male Reproductive System

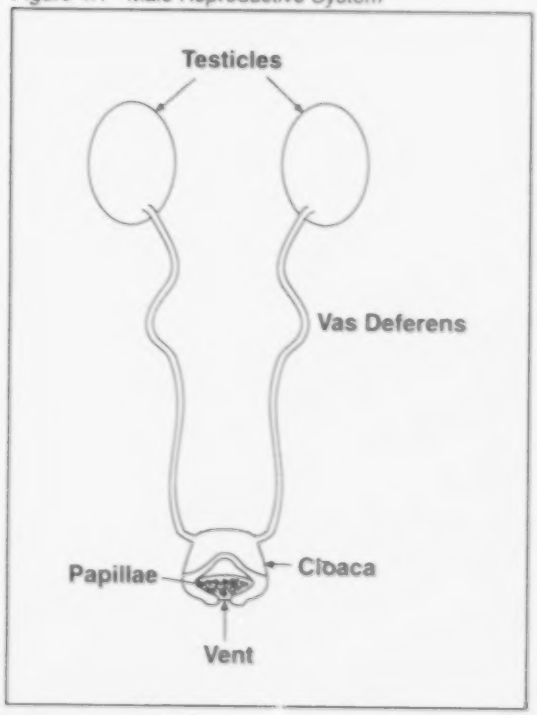
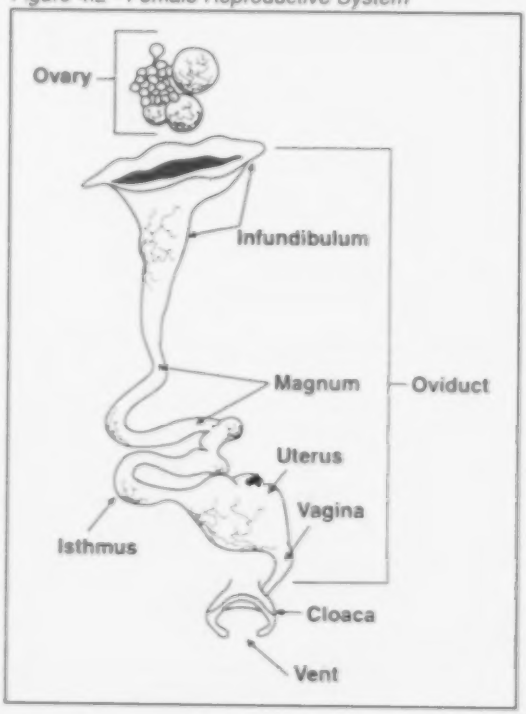


Figure 4.2 - Female Reproductive System



The infundibulum is the funnel-shaped upper portion of the oviduct that receives the mature yolk from the ovary. The yolk spends about 15 minutes in the infundibulum. If live sperm are present, this is the area where the yolk becomes fertilized.

The yolk then moves into the magnum, which is where the albumen is secreted and forms various layers of egg white. The yolk remains in the magnum about three hours.

Next, the egg travels to the isthmus, which adds two shell membranes. The inner and outer shell membranes form to represent the final shape of the egg. At some point, the shell membranes separate and an air cell is formed, usually in the large end of the egg. The membranes act as a barrier to protect from outside organisms and prevent evaporation of the egg contents. The egg remains in the isthmus about an hour and fifteen minutes.

Once the shell membranes have formed, the egg is passed to the uterus. The uterus, also known as the shell gland, adds a thin, white shell. The developing egg remains in the uterus for about 20 hours while water is added through the shell membranes to the albumen, or egg white. Meanwhile, tiny particles of calcium carbonate are laid onto the shell membranes forming the hard outer shell.

Finally the egg is passed into the vagina, which serves only as a passageway, where it remains for a brief period before passing through the cloaca. The egg is held briefly in the cloaca, which is where the egg is held briefly as it rotates so the large end is expelled first. The egg will pass through the vent, which is where the egg, as well as any waste products, pass from the body.

Parts of an Egg

The newly laid egg consists of four primary parts as shown in Figure 4.3: the shell, membrane, albumen, and yolk.

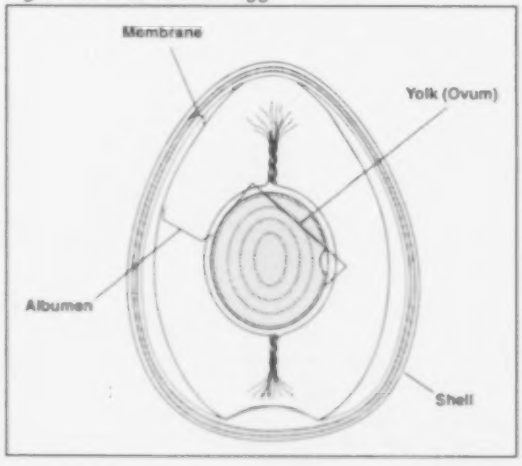
The shell consists of three layers. The first shell is an inner mammillary layer consisting of sponge-like, calcium crystals. The next shell layer is made up of hard calcium crystals. This layer is more compact yet has thousands of microscopic pores that allow moisture and air to enter and exit the egg. Finally the shell is covered by the cuticle, which is a protective layer that helps prevent microorganisms from entering the egg.

Two paper-like membranes made of protein fibers exist inside the shell. The inner membrane holds the contents of the egg tightly together and the outer membrane is connected to the shell. The membranes act as a barrier to outside contaminants and reduce evaporation of the egg contents. The air cell forms at the large end of the shell where the two membranes separate.

The albumen, or egg white, consists of four different layers: the outer thin, firm, inner thin, and the chalaziferous. The yolk is surrounded by the chalaziferous layer. This layer extends into the chalazae, which are two twisted cords extending from opposite ends of the yolk. The chalazae helps to keep the yolk in place. The chalaziferous layer is surrounded by the liquid inner thin layer, then the more firm dense white, then the outer thin layers.

The yolk, or ovum, contains a germ spot, which is the female reproductive cell. The rest of the yolk is made up of layers that are a record of daily growth. The layers get their orange-yellow color from a substance called carotene, which is found in feed. Lighter colored layers reflect growth while the hen is not eating during the night. Darker colored layers indicate daylight hours when the hen is eating and has higher levels of carotene within her system. The yolk is surrounded by a membrane that helps maintain its spherical shape.

Figure 4.3 - Parts of an Egg



Embryo Development

Embryonic development in chicks is an extremely rapid process. The entire embryonic development of a chick from fertilization to hatch is approximately 21 days. The embryo of a fertile egg starts the cell-division process as the egg passes through the warm oviduct of the hen that lays it. The embryo is alive.

Within three hours after fertilization the blastoderm, or fertilized egg, has already divided into two cells. After more cell division the blastoderm is divided into two different layers: the ectoderm and the entoderm. The ectoderm will form the skin, feathers, beak, claws, nervous system, lens and retina of the eyes, lining of the mouth, and lining of the vent. The entoderm will become the lining of the digestive tract, respiratory tract, and other secondary organs. A third layer develops, called the mesoderm, and develops into the bones, muscles, blood system, reproductive organs, and excretory system.

Once the egg has lost connection with the mother's body, the embryo continues to support itself with membranes that will help to utilize food material. These membranes are the allantois, amnion, yolk sac, and chorion. Each of these membranes serves a specific purpose for the developing embryo. Figure 4.4 is a diagram of these membranes in an embryo at approximately 10 days.

Figure 4.4 - Chick Embryo

The allantois serves as the circulatory system. It absorbs oxygen through the pores in the shell and oxygenates the blood and removes carbon dioxide. The allantois also removes wastes from the kidneys, aids in digestion of albumen, and absorbs calcium from the eggshell.

The amnion is filled with amniotic fluid and serves to protect the embryo during development. The yolk sac surrounds the yolk and provides nourishment for the embryo to grow. The yolk sac is then drawn into the body cavity just before hatching and serves as temporary nutrition for the newly hatched chick.

The chorion fuses with the inner shell membrane and forms a protective layer around the allantois while it completes its metabolic functions.

Reproductive Differences of Poultry From Other Livestock

A primary difference in the reproductive process of poultry from that of other livestock is that it occurs more rapidly. For example, the length of time from fertilization to birth for cattle is 281 days, swine is 114 days. The average incubation period for chickens is 21 days and 28 days for turkeys.

Another significant difference is a large portion of the embryonic growth and development of poultry takes place outside the mother's body. The hen prepares the egg but it is expelled from the body in about 24 hours. After the egg is laid, the hen serves only as an incubator until the chick hatches. In other livestock, the entire reproductive process takes place inside the mother.

Poultry differs from other livestock in the parts of the reproductive system as well. A major difference in the male reproductive system is that the testes of the poultry are located within the body cavity along the backbone. The testes of other mammals are located in the scrotum, which hangs from the body. In the female reproductive system of poultry, only one of the two ovaries is functional, whereas both the right and left ovary function in other mammals. Review *Introduction to Animal Reproduction* Student Reference for a comparison of the various reproductive parts of other livestock.

Summary

Reproduction of poultry is different from other livestock in many ways. Male reproductive parts are all located within the body cavity and consist of two testicles, the vas deferens, papillae, and the vent. The female reproductive system includes the ovary and the oviduct. The ovary produces the ova, or yolk. The oviduct, comprised of the infundibulum, magnum, isthmus, uterus, and vagina, develops the membranes that make up the rest of the egg.

The main parts of an egg are the yolk, albumen, shell, and membranes. These components work together to form the fully developed egg. An ovary that becomes fertilized develops into a chick. Embryonic development begins from the time of fertilization and terminates after 21 days when the chick hatches from the egg. The embryo is supported by the yolk sac, amnion, allantois, and chorion.

The major differences in the reproductive process of poultry from other livestock is the length of time the ovum develops into a mature egg and the development of the egg outside of the mother's body.

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Lesson 5: Health Issues

Maintaining poultry flock health is important in today's modern poultry industry. The greater the number of birds, the greater the risk of disease in the flock. Risks from viral and bacterial diseases and parasite infestation are ongoing problems. Through improved sanitation and medical technology, producers can maintain a healthy flock.

Maintaining a Healthy Poultry Flock

Good management of the poultry flock is very important in raising a healthy flock. A good preventive maintenance program will reduce flock stress and prevent disease. The poultry flock should be checked daily for any signs of disease. Any changes in feed and water consumption could be a sign of a disease outbreak.

Strict sanitation guidelines should be followed. Housing and equipment must be thoroughly cleaned and disinfected between each new group of birds. Flocks used for different production purposes should be isolated from each other. It is advisable to bring all the birds onto the farm at once and remove them all at the same time. To avoid bringing in outside diseases, only the caretaker of the flock should enter the housing area. Clean overalls and disinfected footwear should be worn. Visitors should be kept to a minimum. Facilities should be free of parasites, lice, mites, and rodents.

Clean fresh water should be available at all times. Feed should always be easily accessible and set up to reduce competition among the flock as much as possible. The feeders and waterers should be kept clean. Use adequate ventilation to reduce moisture and buildup of noxious gases. A vaccination program to reduce outbreaks of disease should be maintained. All dead birds should be removed immediately and disposed of by incineration, pit, and deep burial according to guidelines established by the Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources.

Prevention and Control of Common Viral Diseases

Viral diseases are microorganisms that require a living cell to survive and duplicate themselves to spread the virus. Viruses can be passed through contaminated equipment, food, clothing, in the air, or through other animals. A virus can easily enter an animal's system through the openings in the body, i.e., eyes, mouth, vent, skin, nose, or through the pores of an egg. Viruses are extremely resistant to sanitation products, which make them even more difficult to control and prevent. Antibiotics cannot kill a virus.

Common Viral Diseases in Poultry

Marek's Disease, also referred to as range paralysis or acute leukosis, affects many different birds but is very common in chickens. The virus is concentrated in the feather follicles and is shed in the dander (sloughed skin and feather cells.) Internal lesions cause massive internal tumors and can result in sudden death. Other symptoms include significant weight loss, diarrhea, and paralysis in the legs, wings, and neck. Most birds are affected between the age of 6 to 16 weeks. This disease is found all over the world and once it is transmitted there is no treatment. To prevent the onset of Marek's disease, day-old chicks should be vaccinated at the hatchery.

Newcastle disease affects several species of birds including turkeys and chickens. It is highly contagious and can infect the whole flock within three to four days. Symptoms in young birds include respiratory problems such as difficulty breathing, sneezing, and gasping. This may be followed by nervous disorders such as paralysis and tremors. In adult chickens, the respiratory problems are more evident. They may also show a reduction in egg production and shell quality decreases. Symptoms in turkeys are usually mild and may be unnoticed unless nervous disorders develop. There is no treatment for Newcastle disease but vaccination is successful.

Avian influenza affects the respiratory and nervous systems of both turkeys and chickens. Major symptoms include coughing, wheezing, and gasping for air. Diarrhea and nervous problems may also suggest Avian influenza. Laying hens may produce significantly fewer eggs or misshapen eggs. The death rate is low. There is no vaccine, however, the use of antibiotics may help reduce secondary infection. Good management helps in prevention.

Fowl pox affects chickens, turkeys, and other birds. The infection is spread slowly by mosquitos

and direct and indirect contact among the fowl. Symptoms include scabbing around the featherless parts of the body such as the comb, wattles, ear lobes, and eyes. Yellow sores may also be found in the mouth and respiratory tract. Affected younger birds will grow slowly and layer hens produce fewer eggs. There is no treatment, but the disease can be prevented by vaccination.

Infectious bronchitis only affects chickens and is considered the most contagious of poultry diseases. It is spread through the air and through contact with clothing, crates, and equipment. Symptoms are confined to the respiratory system and include difficulty breathing, gasping, sneezing, and watery nasal discharge. Death rates of young chicks less than three weeks of age are high. Laying hens may have a dramatic drop in egg production and lay soft-shelled eggs. It is important to vaccinate laying hens. There is no effective treatment for this disease. Ideal environmental conditions are helpful.

Laryngotracheitis mainly affects older chickens. Symptoms include coughing, sneezing, gasping, and weepy eyes. The death rate is high. Laying hens have a reduction in egg production and soft-shelled eggs. Vaccination is available for prevention. No drug treatment is effective.

Prevention and Control of Common Bacterial Diseases

Bacterial diseases are caused by single-celled, microscopic organisms. Bacteria require certain environmental temperature, moisture, and nutrition to multiply. Some bacteria are necessary for proper food digestion. Bacterial diseases that are detrimental to animal health need to be isolated to reduce transmission. Bacteria are easily transmitted through the air, contaminated feed, clothing, equipment, soil, and other diseased animals. Bacterial vaccines are easily developed to eliminate hazardous bacteria from multiplying. An immunity to the vaccine may develop so effective measures to maintain a sanitary environment must be developed.

Common Bacterial Diseases in Poultry

Pullorum disease affects both chickens and turkeys but other fowl can be infected. A hen passes the bacteria to her chicks via the egg and then can be spread by contaminated chicks from one to another in the hatchery. Most outbreaks occur in chicks less than three weeks old. Infection in young birds results in ruffled feathers, labored breathing, a chilled appearance with birds huddling together for warmth, and white diarrhea. The disease results in high losses in production due to death of chicks and the survivors can contaminate unaffected birds. The best prevention has been to do blood tests of the breeder flocks and cull the birds that carry the bacteria. Treatment of the disease includes administering many different types of antibiotics and maintaining sanitary facilities.

Colibacillosis (coliform infections) is caused by strains of the *Escherichia coli* (*E. coli*) organism. *E. coli* is common in intestinal tracts and feces of poultry and is a common organism in the birds' environment. Infections range in severity from mild to severe and can result in respiratory disease, blood disease, intestinal infection, or a combination of any or all conditions. Common symptoms include fever, ruffled feathers, diarrhea, and labored breathing. In severe cases, death may occur suddenly and spread through the flock quickly. Infected birds need to be isolated quickly. Sanitation and management practices reducing organisms in the birds' environment are necessary.

Fowl cholera is the most hazardous infectious disease of turkeys but also infects chickens and many other birds. The organism enters tissues of the mouth and upper respiratory tract. It is not transmitted through the egg. Animals other than birds can be carriers of the disease. Symptoms of the disease include loss of appetite, rapid weight loss, lameness, swollen wattles, difficult breathing, yellowish or green diarrhea, and development of a purple-colored comb. Medicine exists to lessen the disease but it is not always successful and the birds continue to be carriers of the disease. A rigid sanitation program must be followed to aid in the prevention of the disease.

Infectious coryza (roup) is a respiratory disease that affects many older chickens. Outbreaks usually occur from the introduction of infected or carrier birds into a flock. Once a flock is infected, all birds must be considered as carriers. Symptoms include a swollen face around the eyes and wattles, nasal discharge, and sneezing. The disease results in decreased feed and water consumption and egg production in layers is reduced. Antibiotics are helpful for treating the symptoms but the best way to combat the disease

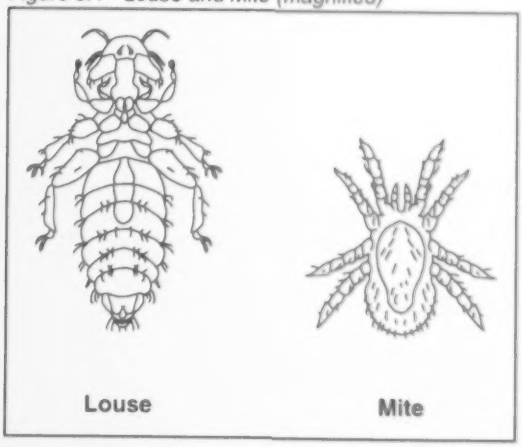
is to cull all carriers in the flock. Good management and sanitation with thorough cleaning and disinfecting will eliminate the disease.

Prevention and Control of Common Parasites

A variety of internal and external parasites cause disease in poultry. Parasites are multicellular organisms that feed off another organism or host. They can be internal or external. Parasites are easily transmitted through contaminated feed, equipment, clothing, and other animals. They consume the nutrients needed to maintain health from the host animal and may eventually cause death. They can survive without a host for a long time and can flourish in hot and humid conditions or cold and dry conditions.

External parasites cause stress to the birds and can cause weight loss and reduce egg production. This results in lower quality and market value. In severe cases, high mortality rates can occur in young poults. The most serious categories of external parasites are lice and mites. Lice (plural for louse) are flat, wingless, fast-moving insects that bite or suck their host. Symptoms are frequent picking, pale head and legs, and loss of weight. Mites are blood-sucking insects that transmit diseases and cause scabbing. Symptoms include reduced egg production, slow growth, damaged feathers, and even death. Prevention of mites and lice includes periodically inspecting the birds for any signs of external parasites. Effective treatment is administered via dusts and sprays. Regulations change on the use of insecticides and it is necessary to check with the local Cooperative Extension Service for recommendations.

Figure 5.1 - Louse and Mite (magnified)



The most common type of internal parasite is intestinal worms that primarily affect birds raised on the range. Worms come in many varieties such as the tapeworm, large roundworm, and gapeworm. They live in the intestines and linings of the bird and cause slow growth and lower production. Treatments for worms are available for each specific type of worm. The flock should be checked periodically for the presence of worms. Rotating flocks raised on the range and maintaining a strict sanitary environment is the best prevention for worms.

Importance of Biosecurity

Biosecurity is a practice designed to prevent the introduction of diseases or parasites into the poultry production operation. This practice will reduce the risk of outside sources of biological organisms such as viruses, bacteria, and parasites from contaminating the flock. Biosecurity has three major components: isolation, traffic control, and sanitation.

Isolation is the practice of controlling the environment by separating birds by age group. An all-in, all-out system is when a producer brings in all of the birds at the same time and at the same age. The producer then markets the birds at the same time and thoroughly cleans, sanitizes, and prepares the facilities for the incoming flock. Isolation practices also keep out unwanted animals that can carry disease organisms.

Traffic control includes both the traffic on the farm and the traffic patterns within the farm. Only authorized personnel should be allowed in or around the production facilities. Vehicle traffic should be kept to a minimum with necessary vehicles cleaned and sanitized before entering the premises.

Sanitation involves the disinfection of materials and equipment entering the farm and the cleanliness of personnel on the farm. For example, employees should shower on their way in and on their way out when moving from one unit to another, wear special clothing to cover skin and hair, or step in detergents that kill microorganisms when entering and exiting rooms within the unit.

Summary

To maintain a healthy poultry flock, a good preventive maintenance program must be carried

out to reduce flock stress and prevent disease. Proper sanitation and clean, fresh food and water are important to maintain flock health.

Common viral diseases include Marek's disease, Newcastle disease, avian influenza, fowl pox, infectious bronchitis, and laryngotracheitis. Common bacterial diseases include pullorum disease, colibacillosis, fowl cholera, and infectious coryza. Many viral and bacterial diseases can be controlled with vaccines. Good sanitation and disinfection are the best ways to reduce poultry diseases.

External parasites such as lice and mites and internal parasites such as worms are easily transmitted. The flock needs to be checked periodically for any infestations of parasites and treated according to recommendations from the local University Extension Service.

Biosecurity will reduce the risk of outside sources from contaminating the flock with viruses, bacteria, and parasites. Important components to observe in biosecurity are isolation, traffic control, and sanitation.

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Lesson 6: Processing and Marketing

Processing and marketing poultry and poultry products has changed dramatically in the past 30 years. Poultry meat and egg processing are very specialized systems with strict procedure and sanitation requirements to ensure quality. By adding value to its products and creating new marketing strategies, the poultry industry has become strong and efficient.

Poultry Meat Processing

In preparation for processing poultry, food (but not water) is removed from the poultry house 8 to 12 hours before taking the birds to the processing plant. Preventing birds from eating before slaughter reduces the amount of food in the intestine. Food in the intestine can cause contamination of the carcass during evisceration. Evisceration is the removal of the intestines, lungs, heart, and other internal organs.

When birds enter the processing plant, they are stunned, bled, scalded, picked, eviscerated, chilled, graded, packaged, and labeled.

- Stunning means to electrically shock the birds to render them unconscious.
- Bleeding allows the blood to drain completely. If the bird is not fully bled, the carcass will have an obvious red color that renders it unsuitable for human consumption.
- Scalding involves submerging the carcass into hot water for a brief period (1.5 to 2 minutes). This relaxes the muscles that hold the feathers, making it easier to remove the plumage (feathers).
- Picking is removing the feathers from the bird. This is done by a machine that has rotating rubber fingers that pull off the feathers. Any feathers that are left pass by a large flame for removal by scorching. The birds are then rinsed with water to remove any foreign matter, blood, or feathers that may be sticking to the carcass.
- Evisceration removes the organs of the abdominal cavity, lungs, and heart from the carcass. The feet, head, and oil gland are also removed at this time.
- The carcass is rapidly chilled in ice water, graded, packaged, and labeled.

The poultry may be either marked as ice-packed, dry, chill-packed, or vacuum-packed frozen. Ice-packing involves setting processed poultry into waxed boxes filled with crushed ice or CO_2 (dry-ice). Dry, chill-packed poultry is placed on a small tray with absorbent paper, wrapped in a plastic wrap, then passed through a blast freezer that does not freeze the meat but chills it. Vacuum-packed frozen poultry is wrapped in plastic bags, then frozen in the blast freezer. It remains frozen until the consumer thaws the product for cooking.

Further Processing/Added Value

The poultry industry has added value to its products by subscribing to the United States Department of Agriculture (USDA) grading system and by further processing the poultry products. By following the USDA poultry grading system, top grade meat can be sold at a higher price than nongraded meat. By further processing meats, the industry also offers added convenience to the consumer and increases sales.

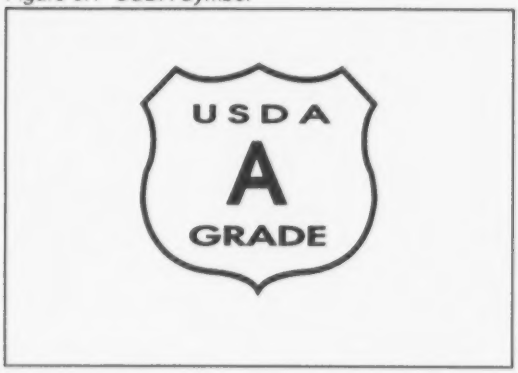
The industry offers the consumer a variety of poultry items that are easy to prepare. Only a small percentage of broilers are sold as whole carcasses. Most are sold as cut-up parts, cooked, or further processed. Such products include breast fillets, nuggets, hot dogs, cold cuts, ground meat, sausages, frozen dinners, and low-fat/low-calorie items. As the consumer is resorting to fast food franchises for quick meals, the poultry industry has provided these markets with cost efficient food products.

Sanitation and Inspection

To give the public a healthy and safe product, the poultry industry is responsible for maintaining strict sanitation regulations as set by the government. Only producers who follow the USDA grading system and pass strict regulations and quality standards for facility and carcass sanitation may bear the quality symbol of the USDA, as shown in Figure 6.1 on page 24.

USDA inspectors make inspections of live birds. They are trained to recognize birds that show symptoms of disease or other problems that would make the birds unsuitable for human consumption. After slaughter, they do inspections of bird carcasses. Inspectors are trained to look for unusual body conditions that would make the carcass unfit to be consumed by humans. The

Figure 6.1- USDA Symbol



carcasses are then graded by trained USDA graders. Inspectors also monitor the facilities, employees, plant grounds, and equipment to be sure all meet the strict standards of sanitation.

Since 1996, legislation requires meat processing plants for all livestock to do routine scientific testing for hazardous bacteria. This is the strictest food safety plan in the history of the meat and poultry industry. The food safety plan, called Hazard Analysis and Critical Control Points (HACCP), is a self-inspection process that focuses on the flow of potentially hazardous foods and how they are handled throughout the operation. The HACCP plan requires:

- Every plant must adopt a plan to deal with specific and potential hazards of the product. The plan will be kept in check by USDA inspectors from the Food Safety and Inspection Service.
- Every slaughter facility must have regular carcass testing for E. coli bacteria.
- All plants that produce ground meat products must have routine testing for Salmonella.
- Every plant must write out and perform a sanitation Standard Operation Procedure (SOP) for meeting sanitation responsibilities.

Egg Processing

Eggs require very little processing since they are naturally a prepackaged food. However, to ensure product safety and quality, there are a few procedures a production facility must follow. The eggs are washed in large commercial egg washers to remove any manure or foreign matter stuck to the shell. It is important that eggs are washed in water that is warmer than the eggs themselves. If they are washed in water that is cooler than the egg, the inside will shrink slightly and create a vacuum. The egg would absorb bacteria from the dirty water through its pores and may contaminate the egg. After being washed, the eggs are air-dried.

When eggs are washed, the protective cuticle, or bloom, is removed. The eggs are oiled with a paraffin-based mineral oil to replace the washed away protective layer. A process called candling is then performed. Candle means to examine an egg in front of a light to observe internal characteristics to determine if the egg is edible or hatchable. The characteristics to look for are the air cell size, yolk shadow position, presence of blood or meat spots, and presence or lack of germ development. The eggs are then culled, removing unsuitable eggs. Eggs must be then be refrigerated. They are then weighed, graded, and packaged for retail.

Egg Marketing

The egg industry has added value to its product by wise marketing and the use of further processing. Fresh and frozen egg products, such as fried or scrambled eggs, crepes, omelets, souffles, quiche, and French toast offer the consumer more convenience. Also, the egg industry provides many fast food restaurants with egg products for breakfast foods.

Marketing strategies have also been effective in the egg market. The American Egg Board has invested in advertising campaigns, for example. This organization promotes the versatility and nutritional benefits of the egg by providing the public with recipes and information. The egg industry also ensures quality by egg grading. Many producers strive for and follow USDA standards because they can sell an egg with the USDA grade symbol at a higher price.

Summary

Major steps in processing poultry include stunning, bleeding, scalding, picking, eviscerating, chilling, candling, grading, packaging and labeling. The poultry has added value to its products by further processing meats and eggs into convenient products for the consumer. Processing facilities have strict sanitation requirements and are subject to the HACCP plan that calls for scientific testing for harmful bacteria. Major steps in egg processing include, collecting, washing, oiling, and

packaging. Eggs are marketed by the American Egg Board with creative advertisements to promote the versatility and nutritional benefits of eggs.

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